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A preliminary treatment of the Bryaceae of the Bryophyte Flora of North America Region

John R. Spence [1]

Introduction. The Bryaceae is a large family of mosses found worldwide in a remarkable variety of habitats, from deserts to arctic tundra to montane tropical rain forests. The family is characterized by a perfect diplolepidous alternate peristome, elongate smooth upper lamina cells, and the acrocarpous habit. In recent years the monophyly of the family has been called into question based on a series of papers examining relationships of selected species using DNA characters (Cox and Hedderson 1998, 2003; Cox *et al.* 2000; Pederson 2000, 2002; Pedersen and Hedenäs 2002). This research has changed our understanding of the family in many ways. For example, the DNA research has shown that *Leptobryum* and *Orthodontium* are not related to the rest of the genera in the Bryaceae, with the former related to the Meesiaceae and the latter probably basal to the pleuorcarpous families. The rest of the genera in the Bryaceae represent at least two distinct lineages. *Pohlia* and related genera (subfamilies Pohlioideae and Mielichhoferioideae) appear to be closer to the Mniaceae based on DNA evidence than to *Bryum* and it's allies. This has led Buck and Goffinet (2000) to place *Pohlia*, *Schizymenium*, *Mielichhoferia*, *Epipterygium*, *Pseudopohlia* and *Synthetodontium* into the Mniaceae. It appears that *Roellia* is also related to the Mniaceae (C. Cox, pers. comm., 2001; cf. Crum 1967). Moving the entire *Pohlia* lineage to the Mniaceae may be premature, however, as detailed comparative studies of the Mniaceae and Pohliodeae have not yet been done. An alternative classification could be proposed where they represent two closely related families. The Bryaceae itself in this more recent strict sense includes primarily the subfamily Bryoideae, including the genera *Acidodontium*, *Anomobryum*, *Brachymenium*, *Bryum*, *Plagiobryum*, *Rhodobryum* and *Rosulabryum*. The status of some poorly known "waif" genera in the Bryaceae, including *Mniobryoides*, *Perssonia*, portions of *Mielichhoferia* (e.g., the *Haplodontium* species) and *Synthetodontium*, need to be critically evaluated. Also, the southern hemisphere genus *Pleurophascum* seems completely out of place in the Bryaceae. Some species of *Mielichhoferia* (e.g., *M. macrocarpa*) and *Haplodontium* appear to be deeply nested within the *Bryum* lineage based on both morphological and genetic research (Pedersen 2002). In addition to the new relationships revealed by DNA data, all studies to date strongly support the hypothesis that peristome reduction (i.e., loss of cilia, reduction of or loss of segments, fusion of exostome and endostome) has occurred independently many

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times within both the *Bryum* and *Pohlia* lineages, and thus is not always a reliable indicator of relationships. The genus *Brachymenium* was erected based primarily on the presence of erect capsules with a reduced peristome. The gametophytes of many *Brachymenium* species are similar to, and in some cases nearly identical to, those of various species or groups of *Bryum*. Also, some species in other genera (e.g., *Anomobryum*) have erect capsules, while many species of *Bryum* have reduced peristomes with nodding capsules. For these reasons, a new look at *Brachymenium* using primarily gametophyte characters is warranted. In an early paper (Spence 1987) I suggested this, but have since modified my views somewhat. My coworker, Dr. Helen Ramsay, and I have submitted a paper analyzing the relationships of the genera of the Bryoideae with gametophytic characters using cladistic methodology (Spence and Ramsay 2003). Our approach has been to characterize small groups of species with similar gametophytes, many of which represent traditional sections of the genera *Bryum* and *Brachymenium*. Typical species from these groups were then used to examine phylogenetic relationships of the Bryoideae using cladistic methods. The classification presented here is based primarily on that study.

This paper has been written in part to encourage other bryologists to examine members of the Bryaceae and to test the proposed classification of North American species presented in this paper. Below, a key to the traditionally defined genera of the Bryaceae of North America north of Mexico is presented. *Roellia* is included because it is very similar to *Rhodobryum*, and two species of *Mielichhoferia* that are closely related and that are probably within the Bryoideae are also included. After the key, each genus and sections within genera are briefly described. Nomenclatural changes will be made elsewhere. Future papers in this series will profile each genus and will include preliminary keys to sections and species. I welcome any thoughts and suggestions regarding the contents of this paper.

The key to understanding *Bryum* is to be able to determine the section a specimen of interest belongs to. Once the identity of the specimen is narrowed down to a section of closely related species, then identification becomes much easier. Principal characters of the gametophore used in sectional assignment include stem appearance (julaceous, comose, rosulate), leaf shape and condition when dry (twisted, contorted, imbricate), leaf border, laminal cell shape, and the presence of specialized gemmae. Capsules are important in some sections, but can actually be a hindrance in others because the presence of sporophytes appears to prevent or at least reduce the production of specialized gemmae. Capsule shape, orientation, and peristome structure and development can also be important characters for assigning a specimen to a section.

Bryum and its relatives produce a remarkable array of specialized vegetation reproductive structures (gemmae). I recognize six principal types, defined below. In general, most species produce either one or two of these structures, although many species lack them altogether. Certain combinations apparently don't occur naturally. For example, only one leaf axis gemmae type is produced per species.

1. Sphaerical rhizoidal tubers: these are small sphaerical to pyramidal structures developed on rhizoids. Typical size is from about 60 um to 500 um across. Important characters include color, size, size of surface tuber cells, and whether the cells are smooth or variously bulging or papillose. In some species the tubers are produced on micronemata on the stem rather than on rhizoids in the substrate. Similar tubers occur in *Pohlia*. Tubers are found in *Brachymenium*, *Bryum* and *Rosulabryum.*
2. Leaf axis bulbils: small structures resembling shoots with leaf primordia generally present. These structures occur in the leaf axils of sterile stems, do not form an obvious stalk attaching them to the stem, and are easily dislodged. Important characters are the size, development and shape of leaf primordia, and number of bulbils per leaf axis. Similar bulbils occur in *Pohlia* and *Mielichhoferia.*
3. Leaf axis filiform gemmae: these are slender structures resembling rhizoids, but with numerous short regularly shaped cells with straight cross walls. They can be branched or unbranched. Occasionally, filiform gemmae can be produced directly from cells of the leaf (cf. Martin 2001; Darigo 2002). Filiform gemmae are produced by species of *Rosulabryum* and *Bryum.*
4. Stem tubers: swollen potato-like structures at the base of stems on or in the substratum. These structures have only recently been described (see El-Saadawi and Zanaty 1990; Spence and Ramsay 1996), and to date have only been found in a few species in *Bryum* section *Doliolidium* and *Brachymenium* section *Dicranobryum*, all restricted to tropical or subtropical seasonally dry regions.
5. Flagelliform branches: these are slender innovations arising from the axils of upper leaves. Typically, they have leaf buds or partly formed leaves (scale leaves), but tend to lack fully developed leaves. They have been found in species of *Bryum* and *Rosulabryum.*
6. Filiform rhizoidal gemmae: small filiform gemmae budding off rhizoids have been reported from *Anomobryum lusitanicum* (I. Hag. ex Luis.) Thér. (Sérgio *et al.* 1996), *Bryum demaretianum* Arts, and *B. tenuisetum* Limpr. (Arts 1992). Their occurrence elsewhere in the Bryaceae is not known. They are superficially remarkably similar to those found in some species of *Archidium* (Arts 1990).

In addition to gemmae, lamina areolation provides many important characters for identification. Although all species of the Bryaceae have distal and median lamina cells that are elongate, the ratio of length to width is important, and also the similarity between these cells and the proximal (basal) cells provide important identification clues. I have recognized four principal patterns of laminal areolation that appear to be correlated with phylogeny, i.e., species in a genus or section tend to have the same type of areolation pattern. However, these should be considered general tendencies, as there is some variation between closely related species, different collections within species, and even leaves of different age on the same plant. Three leaf location terms and their correlation with the leaf are: distal (upper 1/3), median (middle 1/3) and proximal (lower 1/3).

1. *Anomobryum*-type: heterogenous, distal and median lamina cells elongate, mostly 4:1 or greater, long-rhomboidal, hexagonal or linear, proximal cells wider and shorter than cells above, quadrate or short-rectangular, transition often abrupt, giving the areolation a heterogeneous appearance.
2. *Plagiobryum*-type: homogeneous, all cells except in the alar region elongate, mostly 4-8:1, no strong distinction between upper 2/3 and lower 1/3 of leaf. One species, *Bryum incrassatolimbatum* Card., has *Plagiobryum*-like areolation except the cells are relatively short and broad. A few *Pohlia* species in section *Mniobryum* (e.g., *P. wahlenbergii*) show this pattern as well. Similar areolation is found in *Haplodontium* and *Bryum apiculatum* Schwaegr.
3. *Rhodobryum*-type: heterogeneous, distal and median lamina cells short rhomboidal to hexagonal, 2-4:1, proximal cells the same width or narrower, and the same length or longer, more regularly rectangular with squared-off ends, transition rather gradual, but still giving the areolation a heterogeneous appearance.
4. *Pohlia*-type: homogeneous, all lamina cells except those at leaf base long and narrow, mostly linear or hexagonal, often thick-walled.

In addition to the specific gemmae and areolation types, there are also four different costa cross-sectional types in the family, one of which is found only in *Pohlia* and the Mniaceae. The cross-section descriptions are based on sections taken somewhere in the middle third of leaf, but not at the leaf base or tip. These types are named for a genus they are most characteristic of.

1. *Anomobryum*-type: costa lacking guide cells; one stereid band.
2. *Bryum*-type: costa with a single layer of guide cells ventral to the stereid band; one stereid band.
3. *Rhodobryum*-type: costa with two or more layers of guide cells ventral to the stereid band; one stereid band, strongly reduced or usually absent.
4. *Mnium*-type: costa with one layer of guide cells between two stereid bands (not found in the Bryaceae).

Size can be of some use in identifying species of *Bryum*. Both stem length and leaf length categories are described below. I have adopted the leaf lengths from Ochi (1972).

Stem length: short (<10 mm), medium (10-30 mm), long (>30 mm).

Leaf length: small (<1.5 mm), medium (1.5-3.0 mm), large (3.0-4.0 mm), robust (>4.0 mm).

Key to Genera

1. Stems short, julaceous; leaves small, green, yellow-green to silver, if stems not julaceous then plants silver and proximal lamina cells quadrate; lamina areolation *Anomobryum*-type, costa *Anomobryum*-type, mostly not reaching apex, rarely excurrent .... ***Anomobryum***

1. Plants and leaves of various sizes; fertile stems not julaceous although innovations sometimes so; if plants silver then proximal lamina cells elongate-rectangular, if julaceous then leaves >2 mm long and dark red; lamina areolation and costa type various **2**

   2. Plants in dense rhizomatous cushions; leaves mostly imbricate with long spinose partly hyaline hairpoint, lamina areolation dense, *Anomobryum*-type; costa *Bryum*-type; capsules erect; epiphytic-corticolous or saxicolous, peristome reduced, cilia absent ... ***Brachymenium systylium***

   2. Plants not in dense rhizomatous cushions; areolation dense to lax, hairpoint variable, typically not spinose, rarely hyaline, often absent,lamina areolation various, cells short or long; costa type various; capsule erect to nodding, peristome perfect or reduced; habitats various **3**

3. Inflorescences appearing lateral; leaves soft with costa not reaching apex to percurrent, rarely shortly excurrent, lamina areolation *Plagiobryum*-type, alar cells somewhat differentiated from justacostal cells, quadrate; costa *Anomobryum*-type; capsule shortly pyriform, lacking peristome or with exostome only .... ***Haplodontium***

3. Inflorescences terminal; leaves and costa various, percurrent to excurrent, lamina areolation various, alar cells rarely differentiated from justacostal cells, if so then capsule with double peristome; costa type various; capsule shape various, peristome double 4

   4. Leaves strongly twisted, areolation *Anomobryum*-type, apex broadly obtuse, costa extending into short stout point, *Bryum*-type, margins serrate above; capsules erect; saxicolous or epiphytic-corticolous .... ***Brachymenium macrocarpum***

   4. Leaves variously twisted or contorted to imbricate, leaf apex acuminate to acute, if obtuse then costa percurrent or shorter; costa variable, percurrent to long excurrent, upper margins smooth to serrate, areolation-type various, costa type various; capsules nodding or erect,

terricolous, saxicolous or sometimes on rotten wood but not epiphytic 5

5. Lamina areolation *Anomobryum*-type, or if *Plagiobryum*-type plants with rhizoidal tubers; leaves mostly imbricate or rarely slightly twisted at stem apex; stems either budlike or elongate and evenly foliate; rhizoidal tubers and leaf axis bulbils often present; costa *Bryum*-type .... ***Bryum***

5. Lamina areolation either *Rhodobryum*-type or *Plagiobryum*-type (and plants lacking gemmae), leaves variously contorted, twisted or imbricate; stems comose, rosulate or elongate and evenly foliate; rhizoidal tubers or leaf axis filiform gemmae sometimes present; costa type various **6**

6. Plants red-green to pink-silver, with soft imbricate leaves, innovations sometimes julaceous, lamina areolation *Plagiobryum*-type, limbidium lacking, costa *Anomobryum*-type; capsule distinctly zygomorphic, endostome longer than exostome, seta distinctly curved .... ***Plagiobryum***

6. Plants lacking silvery tones, with variously shrunken, contorted or twisted leaves, innovations not julaceous, lamina areolation *Rhodobryum*-type, limbidium of thick elongate cells usually present, costa *Bryum* or *Rhodobryum*-type; capsules not strongly zygomorphic, peristome various, but exostome teeth longer than endostome, seta straight **7**

7. Plants dull red or pink, stems long and evenely foliate, distal lamina cells very short (1.5-3:1), broad, with many irregularly rhomboidal to subquadrate cells; limbidium strong, bi- to multistraose; capsule suberect, somewhat zygomorphic, spores small (10-15 um) .... ***Bryum incrassatolimbatum***

7. Plants various colors and sizes, stems comose, evenly foliate or rosulate, distal lamina cells mostly 3:1 or more, more or less regularly hexagonal or rhomboidal, limbidium distinct or not, sometimes partially bistratose; capsules mostly nodding, more or less symmetric, spore sizes various **8**

8. Stems comose or elongate with equidistinct leaves, not distinctly rosulate; leaves ovate to ovate-lanceolate or lanceolate, widest at or below middle of leaf, lamina margins smooth to finely serrulate but not strongly serrate, border unistratose or bistratose; rhizoidal tubers lacking, leaf axis filiform gemmae rarely present; costa *Bryum*-type; monosetous; terricolous or saxicolous .... ***Bryum***

8. Stems rosulate or rarely elongate with equidistant leaves; leaves obovate or oblong to spathulate, widest above middle, lamina margins serrulate to distinctly serrate, unistratose; rhizoidal tubers and leaf axis filiform gemmae often present, costa *Bryum* or *Rhodobryum*-type various; monosetous or polysetous; habitats various, rarely epiphytic-corticolous **9**

9. Leaves mostly medium to large, upper margins usually serrate to serrulate at apex, stolons absent, costa *Bryum*-type; rhizoidal tubers generally present, filiform gemmae sometimes present in leaf axils; micronemata common on stem; on various substrates including bark of living trees .... ***Rosulabryum***

9. Leaves mostly robust, upper margins distinctly serrate, stolons sometimes present, costa *Rhodobryum*-type; gemmae lacking; stems lacking micronemata; terricolous **10**

    10. Lamina finely rugose, cells large, 90—150 um long by 30—50 um wide, costa not reaching apex; stolons absent .... ***Roellia***

    10. Lamina smooth, cells mostly <100 um long and <35 um wide; costa not reaching apex, percurrent or excurrent; stolons present .... ***Rhodobryum***

Below each genus is discussed, with diagnostic characters. The Appendix includes a list of all 99 species reported from the study area and their suggested generic placement.

1. *Anomobryum* Schimp.

This genus consists of small species with a julaceous habit, concave usually obtuse or acute leaves, elongate distal and median lamina cells, shorter quadrate to short-rectangular and wider proximal cells, and a weak costa. Some species produce bulbiform gemmae in the leaf axils. Sphaerical rhizoidal tubers have not been reported yet from this genus. In cross-section, the costa lacks the layer of large thin walled cells, called guide cells, ventral to the stereid band. In addition to the species usually placed in *Anomobryum*, the silver species (*Bryum argenteum*) and several other North American species of *Bryum* belong in this genus, including *B. blindii*, *B. calobryoides*, and *B. oblongum*. However, *Bryum* was lectotypified with *B. argenteum*, hence the correct name for this genus is *Bryum* instead of *Anomobryum* (Spence & Ramsay 1999, 2002).

2. *Brachymenium* Schwaegr.

As noted in the introduction, *Brachymenium* is almost certainly polyphyletic. Ochi (1992) subdivided the genus into five sections, based on a combination of both gametophyte and sporophyte features. The large type section *Brachymenium* includes epiphytes in tropical to subtropical regions with erect capsules, large spores and primarily monoicous sexuality. The gametophytes of this section are largely inseparable from those of *Rosulabryum*. A second large section is *Dicranobryum*, with gametophytes that are similar to and often indistinguishable from *Bryum* species in sections *Apalodictyon* and *Doliolidium*.

Of the seven species reported from the BFNA area, two are based on misidentifications. All specimens of *Brachymenium speciosum* and *B. wrightii* can be referred to other species, primarily *B. systylium*. This species is in section *Leptostomopsis*. The section is unrelated to other groups of *Brachymenium* and *Bryum*, and deserves generic rank (cf. Cox and Hedderson 2003; Spence & Ramsay 2003). *Brachymenium mexicanum* is close to the *Doliolidium* group in *Bryum* (*B. bicolor*) and should be moved to that genus. The remaining three species are *B. andersonii*, *B. exile*, and *B. macrocarpum*. The rare endemic *B. andersonii* is a distinctive species with an elongate stem and obovate to ovate leaves which are strongly serrate above and contorted when dry. Although it would normally be placed in section *Brachymenium* if it had an erect capsule with reduced peristome, it has never been collected with sporophytes. It is also unlike any other species in section *Brachymenium* in two respects, the habitat (on soil) and the temperate distribution. In these respects it is similar to many species of *Rosulabryum* from elsewhere in the world, and should be transferred to the genus. *Brachymenium macrocarpum* is a distinctive species in section *Rostrata*, and appears to be related to *Bryum* section *Doliolidium* based on leaf structure, differing primarily by its spirally twisted leaves. *B. exile* is a typical member of section *Dicranobryum*, and is very similar to many small species in the *Bryum bicolor* group.

3. *Bryum* Hedw.

The remainder of *Bryum* (excluding *B. argenteum* and *Anomobryum*) includes two major lineages (Spence and Ramsay 2003). One of these can be equated with sections *Amblyophyllum* and *Caespitibryum* (Sections I and portions of II-IV of Smith (1978); Section *Amblyophyllum* and Section *Bryum* subsections *Penduliformia*, *Pseudotriquetra*, and *Caespitibryum* of Nyholm (1993)), while the second major group consists of species in sections *Alpiniformia*, *Apolodictyon*, *Doliolidium*, and *Brachymenium* section *Dicranobryum* (cf. Ochi 1992). These two groups differ in numerous morphological features, but the relationships among the sections within the two groups remain unresolved. These two groups correspond largely to *Bryum* and "*Cernuibryum*" of Spence (1987). More recently, I have started to use the informal name "*Gemmabryum*" for the *Bryum* group of species (sensu Spence 1987), primarily because a majority of species in the four sections appear to be related by their *Anomobryum*-type areolation, mostly imbricate leaves, rhizoidal tubers and leaf axis bulbils. This group appears to be close, at least based on gametophyte morphology and anatomy, to the silver species of *Bryum* and to *Anomobryum*. They differ from these two groups in the *Bryum*-type costa, the general absence of julaceous shoots, and the presence of rhizoidal tubers.

The second group in *Bryum*, "*Cernuibryum*", comprises a maze of closely related confusing primarily northern hemisphere species that reach their greatest diversity in the boreal and arctic-alpine regions. There are two sections that are rather distinct from each other in a variety of features. Species of section *Amblyophyllum* have leaves that are arranged equidistant along the stem and are typically strongly shrunken or contorted when dry, a leaf base that is usually green, bistratose margins, and generally very lax areolation with wide and short distal and median lamina cells. The proximal lamina cells are often much longer than the cells above and rectangular. Section *Caespitibryum* includes species that are densely tufted and comose, with leaves variously contorted or occasionally imbricate, reddish leaf bases with a distinct subalar group of inflated and auriculate pink-colored cells at the insertion, unistratose borders, and narrower distal and median laminal cells. The basal cells are generally about the same width and length as the cells above or sometimes longer, but they are more distinctly rectangular.

The species of "*Cernuibryum*" are notoriously difficult to identify. Species are often recognized by minor differences in capsule shape or peristome structure, and for most capsules are required for identification. Although 41 species have been reported from the BFNA area, the true number is probably fewer. Many very poorly known ones may not survive detailed scrutiny, including *B. axel-blyttii*, *B. brachyneuron*, *B. bryoides*, *B. intermedium*, *B. lonchocaulon*, and *B. oeneum*.

Nyholm (1993) treated *B. caespiticium* and its close allies as a distinct group from the remainder of "*Cernuibryum*", and included in it *B. caespiticium*, *B. badium* and *B. funckii*. The first two are known from the BFNA area, although *B. badium* is a rather weak segregate from *B. caespiticium*.

Haplodontium **Hampe**

Haplodontium consists of species with *Bryum*-like gametophytes and lateral sporophytes with extremely reduced peristomes. There is considerable confusion regarding the circumspection of this genus, *Schizymeniun*, *Mielichhoferia* and *Synthetodontium*. I believe that there has been an over-reliance on peristome characters in defining genera in these taxa. A new look using gametophyte characters is warranted. Shaw *et al.* (1998) alluded to this when they mentioned the gametophyte similarities between *Haplodontium* and *M. macrocarpa*. There are two closely related species of *Mielichhoferia* in North America that differ in many ways from the type species *M. mielichhferiana*. Recent DNA work suggests that *M. macrocarpa* and *M. tehamensis*, are apparently more closely related to the Bryaceae than they are to other species of the genus or to *Schizymenium*. Lamina areolation supports this view, as both species have *Plagiobryum*-type lamination, while *M. mielichhoferiana* has *Pohlia*-type areolation. The two species are distinctive plants, with soft slightly twisted red-green or pink leaves with lax areolation and a small group of thin walled quadrate cells in the alar region. Both are dioicous, but they commonly produce sporophytes. The sporophyte and perichaetium appear lateral because of rapid and extensive innovation growth, and the capsule is erect to inclined, with mostly a single peristome layer. These species appear to be related to *Plagiobryum*, especially to *P. demissum*, and to the tropical *Bryum cellulare*.

The genus *Haplodontium* was synonymized under *Mielichhoferia* by Shaw (1985a). However, as noted in the introduction, the type species, *M. melichhoferiana*, is apparently related to *Pohlia*, while other species originally in *Haplodontium* are more like *Bryum*, and in particular very similar in lamina areolation to *M. macrocarpa* and *M. tehamensis*. After examining several species of *Haplodontium*, including the type, *H. megalocarpum*, I believe that the two North American species are also species of *Haplodontium*. Included within my concept of *Haplodontium* is the genus *Mielichhobryum* Srivast. (Srivastava 1985). Several other small genera, including *Synthetodontium* Card., *Perssonia* Biz., and *Mniobryoides* Hörmann, seem to be related to *Haplodontium* as well.

Plagiobryum Lindb.

Plagiobryum consists of a small group of predominantly northern hemisphere montane species with soft more or less imbricate leaves, julaceous innovations, and long lax lamina cells. The sporophyte is highly distinctive, with a curved seta, a zygomorphic suberect to inclined capsule, an endostome with segments typically longer than the exostome, and spores that occur as tetrads at maturity. All of these features except the last also characterize *Bryum cellulare* and related species. Ochi (1972) pointed out that the species in his section *Areodictyon*, typified by *B. cellulare*, were closely related to *Plagiobryum*. He re-iterated this position in his last paper (Ochi 1992). I agree with him, and in the Flora of Australia *B. cellulare* has been transferred to *Plagiobryum* (Spence *et al.* 2003). Perhaps it is telling that one of the species described by Brotherus, *Plagiobryum wildii*, is a taxonomic synonym of *B. cellulare*.

Recently, the highly distinctive *Bryum incrassatolimbatum* has been described with sporophytes (Ochi and Allen 1990). Remarkably, the sporophyte is similar to those of other *Plagiobryum* species and to *B. cellulare*. Because of its highly unusual leaf structure, the species may be best placed in its own genus near *Plagiobryum*.

Rhodobryum (Schimp.) Hampe

The two species of *Rhodobryum* in North America are characterized by their large size, rosulate habit, obovate leaves with strongly serrate margins, reduced stereid band, stolons and polysety. The chromosomes of *Rhodobryum* are also strikingly different from those of *Bryum* (Ramsay and Spence 1996).

The only other taxa in the BFNA region that can be confused with *Rhodobryum* include *Roellia* and some members of the Mniaceae.

Roellia **Kindb.**

Roellia is a highly distinctive genus endemic to western North America, where it occurs on litter in cool montane and subalpine forests and shrublands. The peristome is highly complex and different from other members of the Bryaceae (Shaw 1985b). Morphologically similar to *Rhodobryum*, the genus has been moved back and forth between the Mniaceae and Bryaceae (cf., Crum 1967). The evidence from DNA studies suggests that it is probably closer to the Mniaceae than to the Bryaceae. It may be best placed in its own family.

Rosulabryum **Spence**

Rosulabryum was described (Spence 1996) to accommodate those species of *Bryum* with rosulate stems and obovate serrate leaves, *Bryum*-type costa cross section, *Rhodobryum*-type lamina areolation, and rhizoidal tubers. A few species also produce filiform leaf axis gemmae. This genus is closely related to the tropical *Brachymenium* section *Brachymenium*. Larger species of *Rosulabryum* are very similar to *Rhodobryum*, but are easily distinguished by the lack of stolons and *Bryum*-type costa. Two species in the BFNA area have already been transferred to *Rosulabryum* (Spence 1996), but another 8-10 species remain in *Bryum*. Most of these species have been previously monographed by Syed (1973) and Mohamed (1979). Recently, Martin (2001) and Darigo (2002) have discussed various forms of *Bryum flaccidum*, including those that were described as *Bryum laevifilum*. I am inclined to accept this species for the present as distinct from *B. flaccidum*, based in part on their observations.

Conclusions. This paper presents my concepts of the Bryaceae for the BFNA region, as of December 2003. As I examine more specimens, I fully expect that the classification will be modified. I have written it in the hopes that other bryologists and researchers will use the key to genera, and provide input based on their own understanding of the family. Any thoughts or criticisms are welcome. No doubt the number of species will change, and the status of some of the undescribed species updated as more collections emerge. Also, more intensive collecting in areas like California, where the Bryum flora is not well understood, such as the U.S. Gulf Region, southeastern Arizona, and western Texas, will likely add additional species from the rich Neotropical and Mexican floras. Future papers in this series will concentrate on particular genera and sections. My hope is to have draft keys available for use for all groups well before the BFNA treatments are published.

Acknowledgements Many thanks to those who have spent time with me in the field in western North America, or have sent interesting specimens for identification, especially Kerry Heise, Ken Kellman, Eve Laeger, Dan Norris, Helen Ramsay, Jim Shevock, Lloyd

Stark, David Torren, and William Weber. My interested in Bryum stems from my time as a graduate student working with Wilf Schofield, who challenged me to learn the genus so he wouldn't have to! The late Harumi Ochi, acknowledged expert on Bryum, kindly supplied me with information on the genus at an early stage of my interest.

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Appendix: List of Genera and Species with traditional sectional placements (from Ochi 1992). No subgeneric classification is proposed at this stage.

Brachymenium Schwaegr.
Section *Leptostomopsis* C. Muell. 1 species
Brachymenium systylium (Mueller) Jaeger
Bryum Hedw. *(Anomobryum* Scimp.)
Section *Bryum* 5 species
Bryum argenteum Hedw.
Bryum blindii Bruch & Schimp.
Bryum gerwigii (C. Mueller) Limpr.
Bryum lanatum P. Beauv.
Bryum oblongum Lindb.
Section *Anomobryum* 3 species
Anomobryum concinnatum (Spruce) Lindb.
Anomobryum julaceum (Gaert., Meyer & Scherb.) Schimp.
Anomobryum leptostomoides Schimp.
Section *Yasudae* 1 species
Bryum calobryoides Spence
Bryum Hedw.
Group I: "*Gemmabryum*" sensu Spence
Section *Apalodictyon* 10 species
Bryum bornholmense Winkel. & Ruthe
Bryum demaretianum Arts
Bryum klinggraeffii Schimp.
Bryum radiculosum Bridel
Bryum rubens Mitten
Bryum ruderale Crundw. & Nyholm
Bryum subapiculatum Hampe
Bryum tenuisetum Limpr.
Bryum valpariense Thér.
(=*Bryum pyriferum* Crundw. & Whiteh.)
Bryum violaceum Crundw. & Nyholm
Section *Apiculata* 1 species
Bryum apiculatum Schwaegr.
Section *Doliolidium* 9 species
Bryum barnesii Wood ex Schimp.
Bryum bicolor Dicks.
Bryum californicum Sull.
Bryum coronatum Schwaegr.
Bryum gemmiferum Wilcz. & Dem.
Bryum gemmiluscens Wilcz. & Dem.
Bryum sp. affinity *Bryum californicum* (CA)
Bryum sp. affinity *Brachymenium exile* (AZ, CA, NV, UT)
Bryum sp. affinity *Bryum bicolor* (BC,CA,ID?, MT?,OR,WA)
Section *Alpiniformia* 7 species
Bryum alpinum With.
Bryum gemmiparum De Not.

Bryum microchaeton Hampe
Bryum mildeanum Jur.
Bryum miniatum Lesq.
Bryum muehlenbeckii Bruch
Bryum sp. affinity *Bryum gemmiparum* (CA)
Section *Dicranobryum* (*Brachymenium*) 3 species
Brachymenium macrocarpum Card.
Brachymenium mexicanum Mont.
Brachymenium exile (Dozy & Molk.) Bosch & Sande Lac.
Group II: "*Cernuibryum*" sensu Spence, *Ptychostomum* Hornschuch, *Cladodium* Bridel
Section *Amblyophyllum* 21 species
Bryum acutiforme Limpr.
Bryum arcticum (Brown) Bruch & Schimp.
Bryum axel-blyttii Philib.
Bryum bryoides (R. Brown) Angstr.
Bryum calophyllum R. Brown
Bryum curvatum Kaurin & Arnell
Bryum cyclophyllum (Schwaegr.) Bruch & Schimp.
Bryum cryophilum Mart.
Bryum marattii Wilson
Bryum meesioides Kindb.
Bryum oeneum Blytt
Bryum pallens Swartz
Bryum purpurascens (R. Brown) Bruch & Schimp.
Bryum reedii Robins.
Bryum rutilans Bridel
Bryum schleicheri Schwaegr.
Bryum turbinatum (Hedwig) Turner
Bryum uliginosum (Bridel) Bruch & Schimp.
Bryum warneum Brifel
Bryum weigelii Spreng.
Bryum wrightii Sull.
Section *Caespitibryum* 20 species
Bryum algovicum Sendt.
Bryum amblyodon C. Muell.
Bryum archangelicum Bruch & Schimp.
Bryum badium (Bridel) Schimp.
Bryum bimum (Schreber) Turner
Bryum brachyneuron Kindb.
Bryum caespiticium Hedw.
Bryum crassirameum Ren. & Card.
Bryum hagenii Limpr.
Bryum intermedium (Bridel) Bland.
Bryum knowltonii Barnes
Bryum lisae var. *cuspidatum* (Bruch & Schimp.) Marg.
Bryum lonchocaulon C. Muell.
Bryum longisetum Schwaegr.
Bryum neodamense Itzig.

Bryum nitidulum Lindb.
Bryum pallescens Schwaegr.
Bryum pseudotriquetrum (Hedwig) Gaert., Meyer & Scherb.
Bryum salinum Limpr.
Bryum teres Lindb.
Haplodontium Hampe *(Mielichhoferia* Nees & Hornsh. in part) 2 species
Mielichhoferia macrocarpa (Hook.) Brush & Schimp.
Mielichhoferia tehamensis Showers
Plagiobryum Lindb.
Section *Areodictyon* 1 species
Bryum cellulare Hook.
Section "*Plagiobryoides*" 1 species
Bryum incrassatolimbatum Card.
Section *Plagiobryum* 2 species
Plagiobryum demissum (Hook.) Lindb.
Plagiobryum zierii (Hedw.) Lindb.
Roellia Kindb. 1 species
Roellia roellii (Broth. *ex* Ruell) Andrew. *ex* Crum
Rosulabryum Spence
Section *Rosulata* 3 species
Brachymenium andersonii Crum
Bryum andicola Hook.
Bryum canariense Bridel
Section *Trichophora* 8 species
Bryum elegans Nees ex Bridel
Bryum erythroloma (Kindb.) Syed
Bryum flaccidum Bridel
Bryum gemmascens Kindb.
Bryum laevifilum Syed
Bryum pseudocapillare Besch.
Rosulabryum capillare (Hedw.) Spence
Rosulabryum torquescens (De Not.) Spence
Rhodobryum (Schimp.) Limpr. 2 species
Rhodobryum ontariense (Kindb.) Paris
Rhodobryum roseum (Hedw.) Limpr.

Wisconsin lichens and lichenicolous fungi collected during the 2002 Tuckerman Lichen Workshop

Compiled by Elisabeth Lay[1]

The Tuckerman Lichen Workshops were started in 1994 by Richard Harris to encourage and assist a group of enthusiastic and knowledgeable amateur lichenologists in the identification of the eastern North American lichen flora. The group has grown from a small handfull to over 30 participants for most workshops.

The Wisconsin workshop, the 11th Tuckerman Workshop, organized by Richard Harris, Bill Buck and Suzy Will-Wolf was held April 25-29, 2002, with collecting activities focused in 3 northern counties: Vilas, Oneida and Lincoln.

John Thomson issued to each participant a pre-release copy of his "The Lichens of Wisconsin" (Thomson 2002) to test the keys. The workshop produced 130 new county records and 47 new state records (included in Appendix 1 of Thomson 2003). With more time, identifications have been submitted for another 59 county and 6 state records.

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* = new county record (based on Thomson, 2003)
** = new state record (based on Thomson, 2003
*** new state record reported but not treated in Thomson, 2003.

WI. Lincoln County: Town of King, Treehaven, ca. 2 mi S of Co. Hwy A on Pickerel Creek Avenue, T.35N., R.7E., sec. 24, ca. 45°30'N, 89°34'W, ca. 450 m; second-growth *Populus*-dominated forest. 25 April 2002. (Note: the date will probably vary with collector).

Amandinea polyspora (Willey) E. Lay & P. May (Buck 41652; Ladd 23667)
Amandinea punctata (Hoffm.) Coppins & Scheid. (Ladd 23673)
Arthonia caesia (Flotow) Körb. (Harris 45793; Kneiper 2211)
Arthonia patellulata Nyl. (Harris 45785, 45787, 45794)
Arthrosporum populorum A. Massal. (Harris 45788; Kneiper 221)

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Bacidia circumspecta (Vainio) Malme (Harris 45781)
Buellia schaereri De Not. (Buck 41657)
Caloplaca cerina (Hedw.) Th. Fr. (Harris 45786D; Kneiper 225; Lay 02-0357)
Caloplaca holocarpa (Hoffm.) M. Wade (Buck 41656; Kneiper 224)
Candelaria concolor (Dickson) Stein (Ahti 61154; Harris 45784; Kneiper 2227)
Candelariella vitellina (Hoffm.) Müll. Arg. (Harris 45786C; Kneiper 223)
Cladonia macilenta var. *bacillaris* (Genth) Schaerer (Ahti 61153)
Cladonia parasitica (Hoffm.) Hoffm. (Ahti 61156)
Evernia mesomorpha Nyl. (Flenniken 5778; Kneiper 2219)
Flavoparmelia caperata (L.) Hale (Ahti 61155; Flenniken 5779)
Flavopunctelia flaventior (Stirton) Hale (Flenniken 5780)
**Flavopunctelia soredica* (Nyl.) Hale (Flenniken 5781)
Hypocenomyce friesii (Ach.) P. James & G. Schneider (Buck 41658)
Hypogymnia physodes (L.) Nyl. (Kneiper 2213)
Lecanora glabrata (Ach.) Malme (Harris 45795)
****Lecanora sambuci* (Pers.) Nyl. (Buck 41653; Harris 45788A; Kneiper 2210)
***Leptorhaphis epidermidis* (Ach.) Th. Fr. (Buck 41662)
Melanelia septentrionalis (Lynge) Essl. (Ladd 23678)
Melanelia subaurifera (Nyl.) Essl. (Flenniken 5782; Ladd 23670, 23672)
Micarea erratica (Körb.) Hertel *et al.* (Buck 41664)
Micarea melaena (Nyl.) Hedl. (Buck 41663)
Micarea prasina Fr. (Harris 45791)
Mycocalicium subtile (Pers.) Szatala (Buck 41661)
Parmelia squarrosa Hale (Flenniken 5783)
Parmelia sulcata Taylor (Flenniken 5784; Kneiper 2212)
Peltigera praetextata (Flörke *ex* Sommerf.) Zopf (Kneiper 2234)
Phaeophyscia ciliata (Hoffm.) Moberg (Harris 45786B; Kneiper 226)
Physcia adscendens (Fr.) H. Olivier (Kneiper 2232)
Physcia aipolia (Humb.) Fürnr. (Harris 45782, 45783)
**Physcia millegrana* Degel. (Kneiper 2216)
Physcia stellaris (L.) Nyl. (Harris 45786A; Kneiper 229)
Physconia detersa (Nyl.) Poelt (Harris 45792)
Physconia leucoleiptes (Tuck.) Essl. (Harris 45789)
Punctelia rudecta (Ach.) Krog (Flenniken 5785)
Punctelia subrudecta (Nyl.) Krog (Flenniken 5786)
Ramalina americana Hale (Flenniken 5787; Harris 45790; Kneiper 2214)
***Stenocybe pullatula* (Ach.) Stein (Ladd 23668)
Stereocaulon tomentosum Fr.(Ladd 23675)
Tuckermannopsis americana (Spreng.) Hale (Flenniken 5788)
Usnea hirta (L.) F. H. Wigg. (Flenniken 5789)
**Usnea subfloridana* Stirton (Flenniken 5790)
Xanthoria hasseana Räsänen (Flenniken 5791; Harris 45786; Kneiper 222)

WI. Vilas County: Town of Land o' Lakes, Northern Highland State Forest, Johnson Lake Barrens State Natural Area, 1.5 mi S of Co. Hwy B on High Lake Road, then 1.2 mi E on Jute Lake Road, T.42N., R.8E., sec. 8, 46°08'40-57"N 89°30'03-09"W, ca. 525 m; logged jack pine barrens. 26 April 2002

Acarospora fuscata (Schrad.) Arnold (Buck 41560; Harris 45826; Lay 02-0339)
Allocetraria oakesiana (Tuck.) Randlane & Thell (Yahr 4212)
Arthonia caesia (Flotow) Körb. (Guccion s.n.; Ladd 23691; Lücking/Cáceres s.n.; Yahr 4216)
Arthonia patellulata Nyl. (Crane 02-376; Guccion s.n.; Harris 45802; Majestyk 2856)
**Arthrosporum populorum* A. Massal. (Lay 02-0042)
**Aspicilia cinerea* (L.) Körb. (Lay 02-0041, 02-0046)
****Aspicilia verrucigera* Hue (Buck 41567)
Bacidia circumspecta (Vainio) Malme (Lay 02-0347)
Bryoria furcellata (Fr.) Brodo & Hawksw. (Buck 41574; Egan 15,804; Flenniken 5792; Lay 02-0348; Lücking/Cáceres s.n.)
Buellia disciformis (Fr.) Mudd [*Hafellia disciformis* (Fr.) Marbach & H. Mayrhofer] (Lücking/Cáceres s.n.)
Calicium abietinum Pers. (Buck 41569)
Caloplaca cerina (Hedw.) Th. Fr. (Bennett 02-0001; Guccion s.n.; Lay 02-0355; Lücking/Cáceres s.n.; Majestyk 2878; May 6093, 6100; Yahr 4219)
**Caloplaca citrina* (Hoffm.) Th. Fr. (May 6093)
Caloplaca holocarpa (Hoffm.) M. Wade (Ladd 23685; Lay 02-0359, 92-0360; Lücking/Cáceres s.n.; Majestyk 2870; May 6093, 6100)
Candelaria concolor (Dickson) Stein (Bennett 02-0002; Guccion s.n.)
****Candelariella reflexa* (Nyl.) Letau (Ladd 23687)
Candelariella vitellina (Hoffm.) Müll. Arg. (Lay 02-0363; May 6089)
Candelariella xanthostigma (Ach.) Lettau (Lücking/Cáceres s.n.)
****Catillaria nigroclavata* (Nyl.) Schuler (Lücking/Cáceres s.n.)
Chaenotheca brunneola (Ach.) Müll. Arg. (Crane 02-372)
Cladonia arbuscula (Wallr.) Flotow (Harris 45805; Majestyk 2861)
Cladonia coniocraea (Flörke) Spreng. (Egan 15,792; Flenniken 5796)
Cladonia cristatella Tuck (Bennett 02-0007; Flenniken 5797; Yahr 4207)
**Cladonia deformis* (L.) Hoffm. (Egan 15,796)
Cladonia frimbriata (L.) Fr. (Bennett 02-0008; Majestyk 2847)
Cladonia furcata (Hudson) Schrad. (Bennett 02-0009)
Cladonia gracilis (L.) Willd. (Bennett 02-0010, 02-0011, 02-0012; Egan 15,812; Flenniken 5797; Yahr 4211)
Cladonia grayi G. Merr. *ex* Sandst. (Yahr 4206)
Cladonia merochlorophaea Asah. (Egan 15,809; Flenniken 5798)
Cladonia mitis Sandst. (Bennett 02-0003; Egan 15,795; Harris 45808, 45810; Majestyk 2855; May 6102; Yahr 4205)
Cladonia multiformis G. Merr. (Egan 15,798, 15,799; Harris 45813; Majestyk 2872; Yahr 4209)
Cladonia ochrochlora Flörke (Majestyk 2949)
Cladonia ramulosa (With.) J. R. Laundon (Flenniken 5795; Harris 45823)
Cladonia rangiferina (L.) F. H. Wigg. (Bennett 02-0004; Crane 02-366; Egan 15,793; Flenniken 5793; Harris 45816; Lay 02-0423; Majestyk 2857)
Cladonia squamosa Hoffm. (Bennett 02-0013; Flenniken 5799)
Cladonia stellaris (Opiz) Pouzar & Vězda (Bennett 02-0005; Egan 15,808; Harris 45822; Majestyk 2853)
Cladonia stygia (Fr.) Ruoss (Bennett 02-0006; Cole 9516; Crane 02-365; Harris 45815; Ladd 23693; Lay 02-0422; Majestyk 2848; May 6096; Trest 401; Yahr 4208, 4220)

Cladonia subtenuis (Abbayes) Mattick (Flenniken 5794)
Cladonia turgida Hoffm. (Egan 15,797; Harris 45811; Majestyk 2846; Yahr 4202 4204)
Cladonia uncialis (L.) F. H. Wigg. (Bennett 02-0014; Egan 15,794; Harris 45797; Yahr 4203)
****Cornutispora ciliata* Kalb (Harris 45817A)
Collema nigrescens (Hudson) DC. (Crane 02-361)
**Cyphelium lucidum* (Th. Fr.) Th. Fr. (Yahr 4222)
Diploschistes muscorum (Scop.) R. Sant. (Lay 02-0358)
**Diploschistes scruposus* (Schreber) Norman (Lay 02-0371)
Evernia mesomorpha Nyl. (Bennett 02-0015; Egan 15,788; Flenniken 5800; Harris 45821; Lay 02-0372; Lücking/Cáceres s.n.; Majestyk 2871)
Flavoparmelia caperata (L.) Hale (Egan 15,810; Flenniken 5801; Lay 02-0375)
Flavopunctelia flaventior (Stirton) Hale (Egan 15,789; Lücking/Cáceres s.n.)
Flavopunctelia soredica (Nyl.) Hale (Flenniken 5802; Lay 02-0376)
Hypocenomyce anthracophila (Nyl.) P. James & Gotth. Schneider (Harris 45803; Majestyk 2881)
**Hypocenomyce friesii* (Ach.) P. James & Gotth. Schneider (Crane 02-370; Egan 15,806)
Hypocenomyce scalaris (Ach.) Choisy (Bennett 02-0016; Buck 41565; Ladd 23680; Lay 02-0379; Majestyk 2862)
Hypogymnia physodes (L.) Nyl. (Bennett 02-0017, 02-0018, 02-0019; Cole 9515; Egan 15,791; Flenniken 5803; Harris 45820; Lücking/Cáceres s.n.; Majestyk 2879)
Imshaugia aleurites (Ach.) S. F. Meyer (Egan 15,800; Flenniken 5804; Harris 45801; Majestyk 2874)
Imshaugia placorodia (Ach.) S. F. Meyer (Cole 9513)
****Lecania cyrtella* (Ach.) Th. Fr. (Buck 41566; Ladd 23686; Lay 02-0060)
Lecanora albella (Pers.) Ach. (Lücking/Cáceres s.n.)
Lecanora allophana Nyl. (Lay 02-0428; Lücking/Cáceres s.n.; May 6081)
Lecanora hagenii (Ach.) Ach. (Lücking/Cáceres s.n.)
Lecanora pulicaris (Pers.) Ach. (Harris 45814; Lücking/Cáceres s.n.; Majestyk 2885)
****Lecanora sambuci* (Pers.) Nyl. (Harris 45800; Lay 02-0061, 02-0062; Majestyk 2852; May 6090)
Lecanora symmicta (Ach.) Ach. (Harris 45799; Lücking/Cáceres s.n.; Majestyk 2884; Yahr 4224)
****Lecidea plana* (J. Lahm) Nyl. (Harris 45812)
Lecidella euphorea (Flörke) Hertel (Bennett 02-0020)
Melanelia exasperata (De Not.) Essl. (Harris 45827A)
Melanelia olivacea (L.) Essl. (Harris 45798; Majestyk 2868; May 6086)
Melanelia septentrionalis (Lynge) Essl. (Crane 02-360, 02-363, 02-367; Egan 15,785; Flenniken 5805; Harris 45827; Ladd 23690; Lay 02-0384; Lücking/Cáceres s.n.; Majestyk 2876, 2882; Yahr 4214)
Melanelia subargentifera (Nyl.) Essl. (Lücking/Cáceres s.n.)
Melanelia subaurifera (Nyl.) Essl. (Egan 15,801; Flenniken 5806; Guccion s.n.; Harris 45817; Lücking/Cáceres s.n.; Majestyk 2877)
Micarea erratica (Körb.) Hertel *et al.* (Buck 41570; Harris 45806)
Micarea melaena (Nyl.) Hedl. (Buck 41559)
****Mycoglaena meridionalis* (Zahlbr.) Szatala (Buck 41558; Ladd 23697; Lay 02-0390)
Parmelia squarrosa Hale (Flenniken 5807; Guccion s.n.)

Parmelia sulcata Taylor (Bennett 02-0022; Egan 15,786; Flenniken 5808; Guccion s.n.; Harris 45818; Lücking/Cáceres s.n.; Majestyk 2865, 2869; Yahr 4223)

Parmeliopsis ambigua (Wulfen) Nyl. (Ladd 23683)*Peltigera canina* (L.) Willd. (Flenniken 5809, 5810; Yahr 4213)

Peltigera praetextata (Sommerf.) Zopf (Flenniken 5811, 5812; Harris 45824; Majestyk 2845)

Phaeophyscia ciliata (Hoffm.) Moberg (Crane 02-377; Flenniken 5813; Guccion s.n.; Lücking/Cáceres s.n.; May 6101; Yahr 4217)

Phaeophyscia pusilloides (Zahlb.) Essl. (Lücking/Cáceres s.n.)

Phaeophyscia rubropulchra (Degel.) Essl. (Lay 02-0400)

Physcia adscendens (Fr.) H. Olivier (Lücking/Cáceres s.n.)

Physcia aipolia (Humb.) Fürnr. (Flenniken 5814; Guccion s.n.; Lücking/Cáceres s.n.)

Physcia stellaris (L.) Nyl. (Flenniken 5815; Lay 02-0403; Lücking/Cáceres s.n.; Yahr 4215)

Physconia detersa (Nyl.) Poelt (Guccion s.n.; Egan 15,815)

Physconia perisidiosa (Erichsen) Moberg (Lay 02-0405)

Placynthiella oligotropha (J. R. Laundon) Coppins & P. James (Buck 41573)

Platismatia tuckermanii (Oakes) Culb. & C. Culb. (Egan 15,802)

Punctelia rudecta (Ach.) Krog (Lay 02-0409)

Punctelia subrudecta (Nyl.) Krog (Lücking/Cáceres s.n.)

Pyrrhospora elabens (Fr.) Hafellner (Egan 15,805; Harris 45809; Majestyk 2880)

Ramalina americana Hale (Bennett 02-0023; Flenniken 5816; Guccion s.n.; May 6087)

Ramalina dilacerata (Hoffm.) Hoffm. (Lücking/Cáceres s.n.)

Rinodina glauca Ropin (Buck 41564; Lay 02-0199, 02-0200)

Rinodina populicola H. Magn. (Lay 02-0201)

***Sarea resinae* (Fr.) Kuntze (Buck 41563; Ladd 23700)

Scoliciosporum chlorococcum (Stenh.) Vězda (Lay 02-0417; Yahr 4221)

***Stenocybe pullatula* (Ach.) Stein (Harris 45828; Lay 02-0037; Lücking/Cáceres s.n.; May 6095)

Stereocaulon paschale (L.) Hoffm. (Bennett 02-0024)

Stereocaulon saxatile H. Magn. (Harris 45829)

Stereocaulon tomentosum Fr. (Bennett 02-0025)

**Trapelia involuta* (Taylor) Hertel (Lay 02-0420)

Trapeliopsis flexuosa (Fr.) Coppins & P. James (Bennett 02-0026; Harris 45807; Majestyk 2854)

Tuckermannopsis americana (Spreng.) Hale (Bennet 02-0027; Buck 41575; Crane 02-364; Egan 15,803; Flenniken 5817; Ladd 23682; Majestyk 2859)

Tuckermannopsis fendleri (Nyl.) Hale (Lay 02-0072)

Tuckermannopsis sepincola (Ehrh.) Hale (Flenniken 5818)

****Umbilicaria deusta* (L.) Baumg. (Trest 400)

Usnea hirta (L.) F. H. Wigg. (Flenniken 5819; Harris 45819; Majestyk 2863)

Usnea subfusca Stirton (Flenniken 5820)

Vulpicida pinastri (Scop.) J.-E. Mattsson & M. J. Lai (Egan 15,807; Flenniken 5821; Harris 45804; Ladd 23696)

Xanthoparmelia cumberlandia (Gyelnik) Hale (Egan 15,813; Flenniken 5822; Guccion s.n.; Harris 45825; Lücking/Cáceres s.n.)

Xanthoria fallax (Hepp) Arnold (Lücking/Cáceres s.n.)

Xanthoria hasseana Räsänen (Bennett 02-0030; Egan 15,790; Flenniken 5823; Guccion s.n.; Lay 02-0421; Lücking/Cáceres s.n.; Majestyk 2866; May 6097; Yahr 4218)
**Xanthoria polycarpa* (Hoffm.) Rieber (Lücking/Cáceres s.n.)
**Xanthoria ulophyllodes* Räsänen (Bennett 02-0031; Egan 15,811; Guccion s.n.; Ladd 23688)

WI. Vilas County: Town of Plum Lake, Northern Highland State Forest, N of Co. Hwy K just E of jct with Old K Road, T.41N., R.8E., sec. 12, 13, 46°02'18"N 89°26'32"W, ca. 540 m; mature sugar maple-yellow birch forest. 26 April 2002

Anaptychia palmulata (Michx.) Vainio (Egan 15,831; Harris 45844; Lay 02-0340; Lücking/Cáceres s.n.; Majestyk 2921)
Anisomeridium polypori (Ellis & Everh.) M. E. Barr (Yahr 4237a)
**Anzia colpodes* (Ach.) Stizenb. (Egan 15,826)
Arthonia byssacea (Weigel) Almq. (Buck 41606; Harris 45850, 45851; Ladd 23721; Lay 02-0342, 02-0343; May 6110, 6107)
Bacidia rubella (Hoffm.) A. Massal. (Lay 02-0048; Lücking/Cáceres s.n.; May 6112; Yahr 4225)
Bacidia schweinitzii (Fr. *ex* E. Michener) A. Schneider (Majestyk 2917)
Bacidia suffusa (Fr.) A. Schneider (Buck 41579; Egan 15,824; Ladd 23718; Lay 02-0049; Lücking/Cáceres s.n.; May 6113; Yahr 4226)
Candelaria fibrosa (Fr.) Müll. Arg. (Lay 02-0362; Lücking/Cáceres s.n.)
Chaenothecopsis debilis (Sm.) Tibell (Buck 41585)
Cladonia coniocraea (Flörke) Spreng. (Bennett 02-0032; Flenniken 5825)
Cladonia ochrochlora Flörke (Harris 45845; Majestyk 2892)
**Collema furfuraceum* (Arnold) Du Rietz (Majestyk 2925)
Collema subflaccidum Degel. (Egan 15,822; Flenniken 5826; Guccion s.n.; Lay 02-0368)
Conotrema urceolatum (Ach.) Tuck. (Buck 41603; Ladd 23713; Lücking/Cáceres s.n.; Majestyk 2920)
Dimerella pineti (Ach.) Vězda (May 6108)
Eopyrenula intermedia Coppins (Lay 02-0074, 02-0374; Yahr 4236)
Evernia mesomorpha Nyl. (Flenniken 5827)
Flavoparmelia caperata (L.) Hale (Egan 15,819; Flenniken 5828; Lücking/Cáceres s.n.)
Graphis scripta (L.) Ach. (Bennett 02-0035 02-0036; Lay 02-0378; Lücking/Cáceres s.n.; Majestyk 2893)
Heterodermia speciosa (Wulfen) Trevisan (Flenniken 5841)
***Homostegia piggotii* (Berk. & Broome) P. Karst. on *Parmelia sulcata* (Cole 9525)
Julella fallaciosa (Arnold) R. C. Harris (Buck 41583)
Lecanora allophana Nyl. (Yahr 4234)
Lecanora symmicta (Ach.) Ach. (Ladd 23732)
Lecanora thysanophora R. C. Harris (Harris 45831; Ketzner 2937; Majestyk 2914; Sliwa 1553)
Lepraria lobificans Nyl. (Harris 45832)
**Leptogium arsenii* Sierk (Flenniken 5829)
Leptogium lichenoides (L.) Zahlbr. (Buck 41599)
Leptogium teretiusculum (Wallr.) Arnold (Lay 02-0075)
Lithothelium hyalosporum (Nyl.) Aptroot (Buck 41588, 41591; Harris 45854)

Lobaria pulmonaria (L.) Hoffm. (Bennett 02-0038; Egan 15,823, 15,833; Flenniken 5830; Majestyk 2909)

Lobaria quercizans Michx. (Egan 15,816, 15,832; Flenniken 5831; Lücking/Cáceres s.n.; Majestyk 2915; May 6117; Sliwa 1546)

Melanelia subargentifera (Nyl.) Essl. (Harris 45834; Majestyk 2888)

Melanelia subaurifera (Nyl.) Essl. (Flenniken 5832)

***Mycoglaena meridionalis* (Zahlbr.) Szatala (Buck 41601; Yahr 4237b)

Myelochroa aurulenta (Tuck.) Elix & Hale (Egan 15,827; Flenniken 5833; Guccion s.n.; Harris 45839; Lücking/Cáceres s.n.)

Myelochroa galbina (Ach.) Elix & Hale (Flenniken 5834; Lücking/Cáceres s.n.)

Myxobilimbia sabuletorum (Schreber) Hafellner (Buck 41582, 41584; Ladd 23705; Lay 02-0424)

Ochrolechia trochophora (Vainio) Oshio (Harris 45855; Ladd 23702; Lücking/Cáceres s.n.)

Opegrapha varia Pers. (Butler 1497a; Harris 45835; Ladd 23712; Lücking/Cáceres s.n.; May 6105)

Parmelia squarrosa Hale (Butler 1498; Flenniken 5835; Guccion s.n.)

Parmelia sulcata Taylor (Cole 9525; Flenniken 5836; Guccion s.n.)

Parmotrema crinitum (Ach.) M. Choisy (Egan 15,825, 15,835; Guccion s.n.; Harris 45856; Lücking/Cáceres s.n.)

Peltigera canina (L.) Willd. (Egan 15,852; Flenniken 5837)

Peltigera evansiana Gyelnik (Egan 15,830, 15,834; Flenniken 5838; Ladd 23706)

**Peltigera horizontalis* (Hudson) Baumg. (Flenniken 5739, 5840)

Peltigera polydactylon (Necker) Hoffm. (Egan 15,829; Flenniken 5837)

Peltigera praetextata (Sommerf.) Zopf. (Flenniken 5839)

Pertusaria amara (Ach.) Nyl. (Buck 41597, 41600)

**Pertusaria leioplaca* DC. (Yahr 4231)

Pertusaria macounii (Lamb) Dibben (Harris 45837, 45852; Lücking/Cáceres s.n.; May 6115; Yahr 4232)

Pertusaria ophthalmiza (Nyl.) Nyl. (Harris 45841; Lay 02-0396; Lücking/Cáceres s.n.)

Pertusaria rubefacta Erichsen (Lücking/Cáceres s.n.)

Pertusaria velata (Turner) Nyl. (Bennett 02-0041; Egan 15,818; Harris 45833; Lay 02-0397, 02-0398; Lücking/Cáceres s.n.; May 6118)

Phaeocalicium polyporaeum (Nyl.) Tibell (Harris 45830)

Phaeophyscia adiastola (Essl.) Essl. (Flenniken 5841)

Phaeophyscia ciliata (Hoffm.) Moberg (Lay 02-0399)

Phaeophyscia hispidula (Ach.) Essl. (Cole 9526; Flenniken 5824; May 6114; Yahr 4233)

Phaeophyscia pusilloides (Zahlbr.) Essl. (Flenniken 5844)

Phaeophyscia rubropulchra (Degel.) Essl. (Crane 02-379; Egan 15,821; Flenniken 5845; Guccion s.n.; Lücking/Cáceres s.n.)

Phaeophyscia squarrosa Kashiwadani (Flenniken 5851, 5842, 5843; Guccion s.n.; Harris 45849; Majestyk 2918; May 6103, 6104, 6119)

Physcia aipolia (Humb.) Fürnr. (Flenniken 5846; Lay 02-0402; Lücking/Cáceres s.n.)

Physcia stellaris (L.) Nyl. (Flenniken 5847)

****Physconia americana* Essl. (Flenniken 5848)

Physconia detersa (Nyl.) Poelt (Egan 15,820; Flenniken 5841, 5849, 5850; Guccion s.n.; Harris 45848; Ladd 23707; Lay 02-0404; Lücking/Cáceres s.n.; May 6116, 6109; Yahr 4229)

Physconia leucoleiptes (Tuck.) Essl. (Majestyk 2916; May 6106; Yahr 4228)
Physconia perisidiosa (Erichsen) Moberg (Lücking/Cáceres s.n.)
Punctelia rudecta (Ach.) Krog (Egan 15,814; Flenniken 5852; Guccion s.n.)
Punctelia subrudecta (Nyl.) Krog (Flenniken 5853)
Pyxine sorediata (Ach.) Mont. (Bennett 02-042; Egan 15,817, 15,828; Flenniken 5854; Guccion s.n.; Harris 45840; Lay 02-0414; Lücking/Cáceres s.n.; Ketzner 2939; Majestyk 2886; May 6111)
Ramalina americana Hale (Flenniken 5855)
Rinodina ascociscana Tuck. (Buck 41586; Butler 1497b; Lücking/Cáceres s.n.; Majestyk 2890; Yahr 4227)
Rinodina subminuta H. Magn. (Harris 45846, 45853A)
*****Sclerophora nivea* (Hoffm.) Tibell (Buck 41587, 41594)
Sphinctrina turbinata (Pers.: Fr.) De Not. (Buck 41589; Harris 45837A, 45842; Ladd 23715; Lay 02-0035)
**Usnea lapponica* Vainio (Flenniken 5856)
*****Verrucaria viridigrana* Breuß (Buck 41577, 41593, 41602)
Xanthoria hasseana Räsänen (Flenniken 5857)

WI. Lincoln County: Town of Rock Falls, along E shore of Wisconsin River at Grandfather Dam, along St. Hwy 107, 0.7 mi S of Co. Hwy E, T.33N., R.6E., sec. 30, 45°18'50"N, 89°47'02"W, ca. 420 m; gneissic boulders and mixed conifer-hardwood forest. 27 April 2002

Acarospora fuscata (Schrad.) Arnold (Egan 15,847; Harris 45883; Lay 02-0039)
Amandinea polyspora (Willey) E. Lay & P. May (Lücking/Cáceres s.n.; Yahr 4250)
Amandinea punctata (Hoffm.) Coppins & Scheid. (Yahr 4240)
Arthonia caesia (Flotow) Körb. (Bennett 02-0045; Lücking/Cáceres s.n.)
*****Arthonia caudata* Willey (Buck 41613, 41615)
**Arthothelium spectabile* A. Massal. (Yahr 4244)
Aspicilia caesiocinerea (Nyl. *ex* Malbr.) Arnold (Bennett 02-0046; Lay 02-0044)
**Aspicilia cinerea* (L.) Körb. (Buck 41624, 41625; Harris 45879; Lay 02-0045)
**Aspicilia laevata* (Ach.) Arnold (Crane 02-394; Egan 15,846)
*****Aspicilia moenium* (Vainio) Thor & Timdal (Buck 41632; Guccion s.n.; Ladd 23723; Lay 02-0047; Sliwa 1564)
Caloplaca feracissima H. Magn. (Buck 41619; Ladd 23727; Lay 02-0358)
Candelaria concolor (Dickson) Stein (Majestyk 2929)
**Candelariella efflorescens* R. C. Harris & W. R. Buck (Ahti 61191)
Candelariella vitellina (Hoffm.) Müll. Arg. (Buck 41630; Ladd 23729)
Cetrelia chicitae (Culb.) Culb. & C. Culb. (Bennett 02-0047; Ketzner 2945)
Cetrelia olivetorum (Nyl.) Culb. & C. Culb (Yahr 4259)
**Cladonia amaurocraea* (Flörke) Schaerer (Egan 15,860)
Cladonia caespiticia (Pers.) Flörke (Ahti 61178; Harris 45880; Yahr 4255)
*****Cladonia carneola* (Fr.) Fr. (Harris 45857)
Cladonia cenotea (Ach.) Schaerer (Harris 45864; Ahti 61186)
Cladonia cervicornis (Ach.) Flotow subsp. *verticillata* (Hoffm.) Ahti (Ahti 61182; Egan 15,843, 15,845; Flenniken 5860; Guccion s.n.)
Cladonia chlorophaea (Sommerf.) Spreng. (Flenniken 5864; Harris 45877; Trest 416)

Cladonia coniocraea (Flörke) Spreng. (Flenniken 5861, 5862, 5863; Harris 45890; Kneiper 2314)

Cladonia crispata (Ach.) Flotow var. *crispata* (Ahti 61184; Egan 15,844; Flenniken 5865)

Cladonia cristatella Tuck. (Ahti 61185; Bennett 02-0048; Egan 15,838; Flenniken 5866; Guccion s.n.; Harris 45889)

Cladonia cryptochlorophaea Asah. (Harris 45877)

**Cladonia cylindrica* (A. Evans) A. Evans (Flenniken 5867; Yahr 4242)

Cladonia furcata (Hudson) Schrad. (Harris 45861)

Cladonia gracilis (L.) Willd. subsp. *turbinata* (Ach.) Ahti (Ahti 61183; Trest 415)

**Cladonia grayi* G. Merr. *ex* Sandst. (Ahti 61162, 61163)

**Cladonia humilis* (With.) J. R. Laundon (Ahti 61164)

Cladonia macilenta Hoffm. (Egan 15,842; Harris 45887)

Cladonia macilenta var. *bacillaris* (Genth.) Schaerer (Ahti 61187)

Cladonia multiformis G. Merr. (Bennett 02-0049; Lay 02-0054)

Cladonia ochrochlora Flörke (Ahti 61167, 61181; Harris 45873, 45875)

**Cladonia peziziformis* (With.) J. R. Laundon (Kneiper 2321)

Cladonia phyllophora Hoffm. (Flenniken 5868; Harris 45888)

Cladonia pleurota (Flörke) Schaer. (Ahti 61170, 61171; Flenniken 5869)

Cladonia pyxidata (L.) Hoffm. (Ahti 61180; Flenniken 5870, 5871; Harris 45885)

Cladonia rangiferina (L.) F. H. Wigg. (Ahti 61174; Egan 15,837; Flenniken 5859; Harris 45870; Majestyk 2928)

Cladonia squamosa Hoffm. (Ahti 61179; Egan 15,861, 15,862; Flenniken 5872; Harris 45864A; Yahr 4239, 4243)

Cladonia subulata (L.) F. H. Wigg. (Ahti 61158)

Dimelaena oreina (Ach.) Norman (Lay 02-0057)

Dimerella pineti (Ach.) Vězda (Buck 41612)

Diploschistes muscorum (Scop.) R. Sant. (Buck 41621; Harris 45862)

Diploschistes scruposus (Schreber) Norman (Harris 45882; Lay 02-0059; Ketzner 2948; Yahr 4260)

Eopyrenula intermedia Coppins (Lücking/Cáceres s.n.)

Evernia mesomorpha Nyl. (Flenniken 5873, 5874)

**Evernia prunastri* (L.) Ach. (Guccion s.n.)

**Flavoparmelia baltimorensis* (Gyelnik & Fóriss) Hale (Flenniken 5875)

Flavoparmelia caperata (L.) Hale (Ahti 61192; Cole 9535; Egan 15,848, 15,853; Flenniken 5876; Harris 45860, 45878)

Flavopunctelia flaventior (Stirton) Hale (Bennett 02-0050; Flenniken 5877)

**Flavopunctelia soredica* (Nyl.) Hale (Flenniken 5878)

Heterodermia speciosa (Wulfen) Trevisan (May 6123)

Hypogymnia physodes (L.) Nyl. (Flenniken 5879; Guccion s.n.; Harris 45871)

**Lecanora polytropa* (Hoffm.) Rabenh. (Kneiper 2312)

Lecanora strobilina (Spreng.) Kieffer (Lücking/Cáceres s.n.)

Lecanora symmicta (Ach.) Ach. (Bennett 02-0052; Lücking/Cáceres s.n.; Yahr 4251)

Lecanora thysanophora R. C. Harris (Bennett 02-0053; Yahr 4241)

Lepraria caesioalba (de Lesd.) J. R. Laundon (May 6137)

Lepraria lobificans Nyl. (Harris 45876; Majestyk 2962; May 6134)

**Lepraria neglecta* (Nyl.) Erichsen (Ahti 61169; Egan 15,841; Yahr 4252)

Leptogium cyanescens (Rabenh.) Körb. (Buck 41610; Egan 15,850; Flenniken 5880; Yahr 4238)
Lobaria pulmonaria (L.) Hoffm. (Lücking/Cáceres s.n.)
Melanelia disjuncta (Erichsen) Essl. (Guccion s.n.)
****Melanelia sorediata* (Ach.) Goward & Ahti (Buck 41623; Harris 45874; Ladd 23731; Lay 02-0386)
Melanelia subaurifera (Nyl.) Essl. (Flenniken 5881; Guccion s.n.; Yahr 4261)
Micarea prasina Fr. (Buck 41622)
****Mycoglaena meridionalis* (Zahlbr.) Szatala (Ladd 23724)
Myelochroa aurulenta (Tuck.) Elix & Hale (Egan 15,856; May 6122)
Myelochroa galbina (Ach.) Elix & Hale (Flenniken 5882)
Ochrolechia arborea (Kreyer) Almb. (Buck 41628; Ladd 23725)
Parmelia squarrosa Hale (Guccion s.n.)
Parmelia sulcata Taylor (Flenniken 5873; Guccion s.n.)
Peltigera didactyla (With.) J. R. Laundon (Harris 45858; Kneiper 2322; Trest 414)
Peltigera elisabethae Gyelnik (Bennett 02-0054; Egan 15,851; Harris 45886; May 6129; Yahr 4254)
Peltigera evansiana Gyelnik (Flenniken 5874)
Peltigera praetextata (Sommerf.) Zopf (Flenniken 5875)
**Peltigera polydactylon* (Necker) Hoffm. (Crane 02-389; Trest 412)
Peltigera rufescens (Weiss) Humb. (Ahti 61165; Guccion s.n.)
Phaeocalicium curtisii (Tuck.) Tibell (Ahti 61172; Buck 41626; Cole 9532; Guccion s.n.; Harris 45869; Kneiper 231; Ladd 23721; Lay 02-0033; Majestyk 2961; May 6127; Sliwa 1565; Yahr 4253)
Phaeocalicium polyporaeum (Nyl.) Tibell (Buck 41609)
Phaeophyscia pusilloides (Zahlbr.) Essl. (Ahti 61188; May 6132)
Phaeophyscia rubropulchra (Degel.) Essl. (Egan 15,855; May 6132)
Physcia aipolia (Humb.) Fürnr. (Guccion s.n.)
**Physcia phaea* (Tuck.) J. W. Thomson (Flenniken 5886)
Physcia stellaris (L.) Nyl. (Flenniken 5887, 5888, 5889, 5890, 5891)
Physcia subtilis Degel. (Cole 9537; Flenniken 5892; Yahr 4248)
Physconia detersa (Nyl.) Poelt (Ahti 61189, 61190)
Physconia leucoleiptes (Tuck.) Essl. (Egan 15,857)
Porpidia albocaerulescens (Wulfen) Hertel & Knoph (Bennett 02-0055; Buck 41614; Egan 15,858)
***Porpidia tuberculosa* (Sm.) Hertel & Knoph (Buschbom s.n.)
Punctelia rudecta (Ach.) Krog (Egan 15,854; Harris 45868; Ketzner 2946)
Ramalina americana Hale (Flenniken 5893, 5894; Yahr 4249)
Ramalina intermedia (Nyl.) Nyl. (Ladd 23727; Yahr 4247)
****Rhizocarpon rubescens* Th. Fr. (Egan 15,839; Harris 45863; Lay 02-0067, 02-0068; Majestyk 2963; May 6126)
**Rhizoplaca chrysoleuca* (Sm.) Zopf (Egan 15,849)
Rhizoplaca subdiscrepans (Nyl.) R. Sant. (Crane 02-390; Lay 02-0069)
Sarcogyne regularis Körb. (Buck 41629; Lay 02-0071; Sliwa 1563)
****Stenocybe pullatula* (Ach.) Stein (Buck 41618)
**Stereocaulon saxatile* H. Magn. (Flenniken 5895)
****Stigmidium fuscatae* (Arnold) R. Sant. (Harris 45863A)
Strigula stigmatella (Ach.) R. C. Harris (Buck 41616)

**Trapeliopsis flexuosa* (Fr.) Coppins & P. James (Ahti 61168; Kneiper 2310)
Trapeliopsis granulosa (Hoffm.) Lumbsch (Lay 02-0419
Tuckermannopsis americana (Spreng.) Hale (Flenniken 5896)
**Tuckermannopsis sepincola* (Ehrh.) Hale (Flenniken 5897)
Umbilicaria mammulata (Ach.) Tuck. (Ahti 61176; Bennett 02-0056; Buck 41607; Egan 15,859; Harris 45865; Lücking/Cáceres s.n.; Ketzner 2944; Yahr 4245)
**Umbilicaria muehlenbergii* (Ach.) Tuck. (Ahti 61173; Yahr 4246)
Usnea hirta (L.) F. H. Wigg. (Flenniken 5898)
**Usnea subfloridana* Stirton (Flenniken 5899, 5900)
Xanthoparmelia conspersa (Ach.) Hale (Egan 15,840a; Flenniken 5901; Harris 45872)
Xanthoparmelia cumberlandia (Gyelnik) Hale (Ahti 61166; Cole 9534; Egan 15,836; Harris 45867, 45884, 45891A; Lücking/Cáceres s.n.)
Xanthoparmelia plittii (Gyelnik) Hale (Bennett 02-0058; Buck 41617; Egan 15,840; Harris 45881; Kneiper 239)
**Xanthoparmelia somloënsis* (Gyelnik) Hale (Flenniken 5902; Guccion s.n.)
Xanthoria hasseana Räsänen (Crane 02-386; Flenniken 5903; Guccion s.n.)

WI. Oneida County: Town of Enterprise, Oneida County Forest, 0.2 mi N of South Exit off Langlade Co. Hwy Q, T.35N., R.9E., sec. 34, 45°28'22"N 89°21'54"W, ca. 500 m; upland mixed hardwood forest. 27 April 2002

Amandinea polyspora (Willey) E. Lay & P. May (Butler 1509d)
Anisomeridium polypori (Ellis & Everh.) M.E. Barr (Guccion s.n.)
Arthonia caesia (Flotow) Körb. (Butler 1509c; Lay 02-0040)
Arthonia radiata (Pers.) Ach. (Ladd 23733)
**Arthrosporum populorum A.* Massal. (Lay 02-0043)
Bacidia diffracta S. Ekman (Buck 41641)
Bacidia rubella (Hoffm.) A. Massal. (Harris 45896)
****Biatora longispora* (Degel.) Printzen (Egan 15,864)
Caloplaca cerina (Hedw.) Th. Fr. (Guccion s.n.)
**Caloplaca holocarpa* (Hoffm. *ex* Ach.) M. Wade (Crane 02-396; Yahr 4262)
Candelaria concolor (Dickson) Stein (Egan 15,868; Lay 02-0361)
Candelaria fibrosa (Fr.) Müll. Arg. (Flenniken 5942; Harris 45893)
Candelariella vitellina (Hoffm.) Müll. Arg. (Lay 02-0052)
Cladonia caespiticia (Pers.) Flörke (Guccion s.n.)
Cladonia chlorophaea (Sommerf.) Spreng. (Flenniken 5943)
Conotrema urceolatum (Ach.) Tuck. (Bennett 02-0059; Buck 41637; Lücking/Cáceres s.n.; May 6146; Yahr 4264)
Eopyrenula intermedia Coppins (Harris 45906; May 6145)
Evernia mesomorpha Nyl. (Flenniken 5944)
Flavoparmelia caperata (L.) Hale (Flenniken 5945)
**Flavopunctelia soredica* (Nyl.) Hale (Flenniken 5946)
Graphis scripta (L.) Ach. (Buck 41642; Crane 02-406; Egan 15,865; Lücking/Cáceres s.n.; Majestyk 2981)
Julella fallaciosa (Arnold) R. C. Harris (Buck 41639; Butler 1508b; Crane 02-398, 02-404; Ladd 23734; Lay 02-0096; Lücking/Cáceres s.n.)
Lecanora allophana Nyl. (Bennett 02-0060; Yahr 4269)
Lecanora caesiorubella Ach. (May 6142)

Lecanora glabrata (Ach.) Malme (Buck 41638)
Lecanora hybocarpa (Tuck.) Brodo (Buck 41644; Harris 45905; May 6141, 6143; Yahr 4263, 4268)
Lecanora impudens Degel. (Bennett 02-0061)
Lecanora symmicta (Ach.) Ach. (Bennett 02-0062; Crane 02-397)
Lecanora thysanophora R. C. Harris (Bennett 02-0063; Buck 41633; Butler 1509b; Egan 15,866; Guccion s.n.; Lücking/Cáceres s.n.; Yahr 4270)
Melanelia olivacea (L.) Essl. (Flenniken 5947)
Melanelia septentrionalis (Lynge) Essl. (Lay 02-0385)
***_Melanelia sorediata_ (Ach.) Goward & Ahti (May 6124, 6125)
Melanelia subaurifera (Nyl.) Essl. (Flenniken 5948; Lay 02-0388; Yahr 4267)
***_Mycocalicium albonigrum_ (Nyl.) Fink (Buck 41645)
*_Mycocalicium subtile_ (Pers.) Szatala (Crane 02-405; Lay 02-0031)
Myelochroa aurulenta (Tuck) Elix & Hale (Flenniken 5949, 5950; Guccion s.n.; Ketzner 2955)
Myelochroa galbina (Ach.) Elix & Hale (Flenniken 5951)
*_Myelochroa obsessa_ (Ach.) Elix & Hale (Crane 02-403)
***_Nectriopsis parmeliae_ (Berk. & M. A. Curtis) M. S. Cole & D. Hawksw. (Harris 45892)
Parmelia squarrosa Hale (Flenniken 5952; Harris 45901)
Parmelia sulcata Taylor (Flenniken 5953)
Peltigera didactyla (With.) J. R. Laundon (May 6136)
Peltigera praetextata (Sommerf.) Zopf (Flenniken 5954; Harris 45894)
Peltigera rufescens (Weiss) Humb. (Flenniken 5955)
Phaeophyscia ciliata (Hoffm.) Moberg (Guccion s.n.)
Phaeophyscia hirtella Essl. (Buck 41647)
Phaeophyscia pusilloides (Zahlbr.) Essl. (Flenniken 5956)
Phaeophyscia rubropulchra (Degel.) Essl. (Butler 1508a; Flenniken 5957; Guccion s.n.)
Phaeophyscia squarrosa Kashiwadani (Harris 45900; Yahr 4265)
***_Phoma physciicola_ Keissler (Buck 41648)
Physcia aipolia (Humb.) Fürnr. (Bennett 02-0064; Flenniken 5958; Guccion s.n.; Majestyk 2983)
Physcia millegrana Degel. (Butler 1509a; Flenniken 5959; Harris 45897; Yahr 4266;)
Physcia stellaris (L.) Nyl. (Egan 15,863)
Physconia detersa (Nyl.) Poelt (Crane 02-402; Flenniken 5960; Guccion s.n.; Harris 45904)
Physconia leucoleiptes (Tuck.) Essl. (Bennett 02-0065)
Punctelia rudecta (Ach.) Krog (Flenniken 5961, Guccion s.n.; Lay 02-0408)
Pyxine sorediata (Ach.) Mont. (Flenniken 5961; Harris 45903; Lay 02-0411)
Ramalina americana Hale (Cole 9565; Flenniken 5962, 5963; May 6139)
*_Rinodina glauca_ Ropin (Lay 02-0415)
*_Rinodina populicola_ H. Magn. (Lay 02-0198)
Scoliciosporum chlorococcum (Stenh.) Vězda (Lay 02-0416)
Strangospora microhaema (Norman) R. Anderson (Harris 45903A)
Xanthoria fallax (Hepp) Arnold (Flenniken 5964)
Xanthora fulva (Hoffm.) Poelt & Petutschnig (Harris 45898)
Xanthoria hasseana Räsänen (Guccion s.n.; Lay 02-0073; Majestyk 2984)
*_Xanthoria polycarpa_ (Hoffm.) Rieber (Flenniken 5965)

**Xanthoria ulophyllodes* Räsänen (Crane 02-401; Egan 15,867)

WI. Vilas County: Town of Arbor Vitae, Northern Highland State Forest, Trout Lake Conifer Swamp State Natural Area, just N of Co. Hwy M at E end of Perch Lane, T.41N., R.7E., sec. 19, 46°00'52"N, 89°39'26"W, ca. 466 m; mixed *Thuja-Picea* swamp. 28 April 2002

Anisomeridium polypori (Ellis & Everh.) M. E. Barr (Buck 41682)
Arthonia fuliginosa (Schaerer) Flotow (Bennett 02-0067; Harris 45917, 45934A; Yahr 4289)
Bacidia circumspecta (Vainio) Malme (Harris 45927)
Bacidia diffracta S. Ekman (Harris 45945; Ladd 23753)
Bacidia rubella (Hoffm.) A. Massal (Lücking/Cáceres s.n.)
Bacidia schweinitzii (Michener) A. Schneider (Buck 41711; Crane 02-417; Egan 15,879, 15,888; Guccion s.n.; Lay 02-0345; Lücking/Cáceres s.n.; Majestyk 3006; Yahr 4288)
****Biatora toensbergii* Holien & Printzen (Buck 41666, 41677, 41699)
Bryoria furcellata (Fr.) Brodo & D. Hawksw. (Bennett 02-0068; Guccion s.n.; Lay 02-0349; Yahr 4285)
Bryoria trichodes (Michx.) Brodo & D. Hawksw. ssp. *trichodes* (Buck 41722; Egan 15,871)
Buellia disciformis (Fr.) Mudd [*Hafellia disciformis* (Fr.) Marbach & H. Mayrhofer] (Yahr 4286)
Buellia erubescens Arnold (Lücking/Cáceres s.n.)
Buellia schaereri De Not. (Buck 41695)
Buellia stillingiana J. Steiner (Buck 41673, 41696; Lücking/Cáceres s.n.)
Calicium parvum Tibell (Buck 41685; Lay 02-0023)
**Calicium trabinellum* (Ach.) Ach. (Trest 449)
Cetrelia olivetorum (Nyl.) Culb. & C. Culb. (Egan 15,877; Harris 45916)
Chaenotheca brunneola (Ach.) Müll. Arg. (Buck 41705; Kneiper 258; Lay 02-0024)
Chaenotheca ferruginea (Turner *ex* Sm.) Migula (Buck 41672; Ladd 23744; Lay 02-0365)
Chaenotheca furfuracea (L.) Tibell (Buck 41687)
Chaenotheca laevigata Nádv. (Harris 45918; Ladd 23761)
Chaenotheca stemonea (Ach.) Müll. Arg. (Buck 41713, 41715)
Chaenotheca trichialis (Ach.) Th. Fr. (Harris 45925; Ladd 23760; Lay 02-0028, 02-0029)
Chaenothecopsis savonica (Räsänen) Tibell (Buck 41720; Kneiper 252)
****Chrysothrix candelaris* (L.) J. R. Laundon (Kneiper 257)
Conotrema urceolatum (Ach.) Tuck. (Lücking/Cáceres s.n.)
Cresponea chloroconia (Tuck.) Egea & Torrente (Buck 41684; Egan 15,876; Harris 45935, 45947, 45949; Ladd 23750; Lay 02-0055, 02-0370)
Dimerella lutea (Dickson) Trevisan (Lücking/Cáceres s.n.; Yahr 4287, 4290)
Evernia mesomorpha Nyl. (Egan 15,881; Harris 45910; Lay 02-0373)
**Evernia prunastri* (L.) Ach. (Guccion s.n.)
Flavoparmelia caparata (L.) Hale (Egan 15,880; Guccion s.n.; Harris 45931)
Graphis scripta (L.) Ach. (Bennett 02-0069; Harris 45943; Lücking/Cáceres s.n.; Majestyk 3001)
Heterodermia speciosa (Wulfen) Trevisan (Buck 41691; Butler 1512e; Egan 15,889)
Hypogymnia physodes (L.) Nyl. (Butler 1510a; Egan 15,886; Guccion s.n.; Harris 45942)
Icmadophila ericetorum (L.) Zahlbr. (Buck 41667)

**Lecania naegelii* (Hepp) Diederich & v.d. Boom (Yahr 4281)
Lecanora albella (Pers.) Ach. (Egan 15,874; Lücking/Cáceres s.n.)
Lecanora albella var. *rubescens* (Imshaug & Brodo) Lumbsch (Buck 41675; Harris 45938)
**Lecanora casiorubella* Ach. (Yahr 4273)
****Lecanora meridionalis* H. Magn. (Buck 41676, 41697; Harris 45909, 45919, 45940)
Lecanora rugosella Zahlbr. (Buck 41698, 41707)
Lecanora symmicta (Ach.) Ach. (Lücking/Cáceres s.n.)
Lecanora wisconsinensis H. Magn. (Buck 41670, 41690, 41714; Egan 15,955; Harris 45922, 45923, 45924)
****Lepraria rigidula* (de Lesd.) Tønsberg (Harris 45912, 45951)
Lobaria quercizans Michx. (Cole 9543; Guccion s.n.)
****Lopadium disciforme* (Flotow) Kullhem (Buck 41694)
Loxospora cismonica (Beltr.) Hafellner (Buck 41719; Harris 45936)
Loxospora elatina (Ach.) A. Massal. (Buck 41704; Egan 15,882; Guccion s.n.; Harris 45926, 45946; Ladd 23741)
Loxospora pustulata (Brodo & Culb.) R. C. Harris (Bennett 02-0072; Crane 02-411; Guccion s.n.)
Melanelia subaurifera (Nyl.) Essl. (Guccion s.n.)
**Menegazzia terebrata* (Hoffm.) A. Massal (Kneiper 2510; Majestyk 2985)
Micarea melaena (Nyl.) Hedl. (Buck 41671)
****Multiclavula mucida* (Fr.) R. Petersen (Buck 41669)
Mycocalicium subtile (Pers.) Szatala (Buck 41674; Harris 45915; Kneiper 256; Lay 02-0064, 02-0389)
Myelochroa aurulenta (Tuck.) Elix & Hale (Egan 15,894)
Myxobilimbia sabuletorum (Schreber) Hafellner (Buck 41701, 41721; Egan 15,895)
Ochrolechia androgyna (Hoffm.) Arnold (Buck 41717)
Ochrolechia arborea (Kreyer) Almb. (Bennett 02-0073; Butler 1512b))
Ochrolechia trochophora (Vainio) Oshio (Ladd 23762; Lay 02-0391)
****Opegrapha diffracticola* R. C. Harris & D. Ladd (Harris 45945A)
Opegrapha varia Pers. (Harris 45939; Lay 02-0392; Yahr 4280)
****Opegrapha vulgata* Ach. (Buck 41709)
Parmelia squarrosa Hale (Bennett 02-0074; Egan 15,872; Guccion s.n.; Harris 45933)
Parmelia sulcata Taylor (Butler 1510b; Guccion s.n.)
Parmotrema crinitum (Ach.) M. Choisy (Butler 1512c; Egan 15,887, 15,891; Harris 45913)
Pertusaria amara (Ach.) Nyl. (Egan 15,870; Guccion s.n.; Harris 45920, 45950; Lay 02-0394)
Pertusaria consocians Dibben (Buck 41686; Harris 45908, 45934, 45944)
Pertusaria macounii (Lamb) Dibben (Yahr 4277)
Pertusaria multipunctoides Dibben (Buck 41692)
Pertusaria ophthalmiza (Nyl.) Nyl. (Bennett 02-0075; Buck 41679; Guccion s.n.; Harris 45929, 45941; Lay 02-0395; Lücking/Cáceres; Yahr 4272)
Pertusaria rubefacta Erichsen (Buck 41681, 41710)
Pertusaria trachythallina Erichsen (Buck 41718)
Pertusaria velata (Turner) Nyl. (Buck 41716)
**Phaeophyscia cernohorskyi* (Nádv.) Essl. (Yahr 4278)
Phaeophyscia rubropulchra (Degel.) Essl. (Butler 1512f)

Phlyctis argena (Spreng.) Flotow (Buck 41683; Harris 45948; Ladd 23751)
Platismatia tuckermanii (Oakes) Culb. & C. Culb. (Egan 15,885, 15,890; Harris 45932; Majestyk 2995, 2999)
Punctelia rudecta (Ach.) Krog (Butler 1511; Crane 02-416; Guccion s.n.; Harris 45930)
Punctelia subrudecta (Nyl.) Krog (Egan 15,884)
****Pyrenula laevigata* (Pers.) Arnold (Buck 41678)
**Pyrenula pseudobufonia* (Rehm) R. C. Harris (Yahr 4271)
Pyxine sorediata (Ach.) Mont. (Egan 15,878; Guccion s.n.; Lay 02-0412)
Rinodina degeliana Coppins (Harris 45911)
Rinodina excrescens Vainio (Buck 41689; Harris 45919A)
Strigula stigmatella (Ach.) R. C. Harris (Buck 41668, 41680)
****Thelenella pertusariella* (Nyl.) Vainio (Harris 45921)
Trapeliopsis viridescens (Schrad.) Coppins & P. James (Buck 41700)
Usnea cavernosa Tuck. (Crane 02-414; Egan 15,869; Guccion s.n.; Harris 45952; Kneiper 251)
Usnea hirta (L.) F. H. Wigg. (Yahr 4283)
Usnea subfloridana Stirton (Crane 02-415; Harris 45953)
**Usnea trichodea* Ach. (Yahr 4284)

WI. Oneida County: Town of Woodruff, Northern Highland State Forest, Hemlock Lake Boat Ramp along Woodruff Road on SW shore of Hemlock Lake, T.39N., R.7E., sec. 17, 18, 45°52'24"N, 89°39'17"W, ca. 534 m; mature hemlock forest. 28 April 2002

Arthonia caesia (Flotow) Körb. (Buck 41725)
****Arthonia caudata* Willey (Buck 41726)
****Arthonia helvola* (Nyl.) Nyl. (Buck 41732; Lay 02-0041)
****Biatora toensbergii* Holien & Printzen (Lay 02-0050)
Bryoria furcellata (Fr.) Brodo & D. Hawksw. (Guccion s.n.; Harris 45961)
Buellia arnoldii Servít & Nádv. (Lay 02-0051)
Buellia dialyta (Nyl.) Tuck. [*Chrismofulvea dialyta* (Nyl.) Marbach] (Bennett 02-0077; Buck 41727; Egan 15,899; Guccion s.n.; Lay 02-0350)
Buellia schaereri De Not. (Harris 45959; Lay 02-0353)
Calicium parvum Tibell (Lay 02-0038)
Candelaria concolor (Dickson) Stein (Crane 02-426)
Chaenotheca furfuracea (L.) Tibell (Lay 02-0025)
Cladonia macilenta Hoffm. (Harris 45960)
Cladonia ochrochlora Flörke (Harris 45956)
Cladonia rangiferina (L.) F. H. Wigg. (Egan 15,901)
Conotrema urceolatum (Ach.) Tuck. (Lay 02-0369)
Evernia mesomorpha Nyl. (Cole 9562; Egan 15,903; Kneiper 261)
Flavoparmelia caperata (L.) Hale (Crane 02-425; Ketzner 2967)
Graphis scripta (L.) Ach. (Crane 02-423; Lay 02-0377; Majestyk 3029)
Hypocenomyce scalaris (Ach.) M. Choisy (Harris 45962)
Hypogymnia physodes (L.) Nyl. (Crane 02-424; Guccion s.n.)
Lecanora pulicaris (Pers.) Ach. (Buck 41729)
Lecanora thysanophora R. C. Harris (Harris 45954)
**Lepraria incana* (L.) Ach. (Crane 02-422)

Lobaria pulmonaria (L.) Hoffm. (Egan 15,896; Majestyk 3030)
Lobaria querzicans Michx. (Cole 9563)
Loxospora elatina (Ach.) A. Massal. (Harris 45958; Lay 02-0382)
****Micarea endocyanea* (Willey) R. C. Harris (Buck 41724, 41728)
Pertusaria macounii (Lamb) Dibben (Egan 15,900)
Phaeophyscia rubropulchra (Degel.) Essl. (Egan 15,897)
Phlyctis argena (Spreng.) Flotow (Harris 45963)
Physcia millegrana Degel. (Egan 15,898)
Punctelia subrudecta (Nyl.) Krog (Guccion s.n.)
Ramalina americana Hale (Egan 15,898)
Rinodina subminuta H. Magn. (Harris 45957)
Scoliciosporum chlorococcum (Stenh.) Vězda (Buck 41730)
Tuckermannopsis americana (Spreng.) Hale (Guccion s.n.)
Usnea hirta (L.) F. H. Wigg. (Egan 15,902)

WI. Oneida County: Town of Minocqua, Patterson Hemlocks State Natural Area, 1.2 mi S of St. Hwy 70 on West Clear Lake Road, T.39N., R.4E., sec. 3, 45°53'51"N, 89°57'45"W, ca. 500 m; *Thuja* swamp adjacent to a hemlock-hardwood forest. 29 April 2002

****Abrothallus microspermus* Tul. (Buck 41746)
Anaptychia palmulata (Michx.) Vainio (Harris 45983)
Anisomeridium polypori (Ellis & Everh.) M. E. Barr (Buck 41790)
****Arthonia apatetica* (A. Massal.) Th. Fr. (Harris 45988A)
Arthonia byssacea (Weigel) Almq. (Buck 41792; Harris 45975, 45991, 46021)
Arthonia caesia (Flotow) Körb. (Harris 45997B)
Arthonia didyma Körb. (Harris 45996)
Arthonia fuliginosa (Schaerer) Flotow (Harris 46013)
Bacidia bagliettoana (Massal. & De Not.) Jatta (Buck 41815A; Lay 02-0346)
Bacidia diffracta S. Ekman (Buck 41783)
Bacidia schweinitzii (Michener) A. Schneider (Crane 02-437; Egan 15,928; Harris 45992, 46003A; Lay 02-0344)
Bacidia suffusa (Fr.) A. Schneider (Butler 1521a; Harris 45993, 46002, 46003)
****Biatora longispora* (Degel.) Printzen (Buck 41733, 41738, 41747, 41768; Harris 45967A, 45988, 46018)
Buellia dialyta (Nyl.) Tuck. [*Chrismofulvea dialyta* (Nyl.) Marbach] (Egan 15,911; Harris 45969,46005; Lay 02-0351, 02-0352)
Buellia schaereri De Not. (Lay 02-0354)
Candelariella vitellina (Hoffm.) Müll. Arg. (Harris 46007A)
****Catillaria nigroclavata* (Nyl.) Schuler (Lay 02-0053)
Cetrelia cetrarioides (Dulby) Culb. & C. Culb. (May 6149)
Cetrelia chicitae (Culb.) Culb. & C. Culb. (Egan 15,922, 15,930; Flenniken 5918, 5919; Harris 46038)
Cetrelia olivetorum (Nyl.) Culb. & C. Culb. (Egan 15,932; May 6148)
Chaenotheca chrysocephala (Ach.) Th. Fr. (Bennett 02-0079; Egan 15,912)
Chaenotheca furfuracea (L.) Tibbell (Lay 02-0364)
****Chaenotheca gracillima* (Vainio) Tibell (Lay 02-0026)
Chaenotheca laevigata Nádv. (Buck 41785; Lay 02-0366)

Chaenotheca trichialis (Ach.) Th. Fr. (Buck 41798, 41799, 41800; Lay 02-0030)
Chaenothecopsis savonica (Räsänen) Tibell (Lay 02-0027, 02-0032)
****Chrysothrix candelaris* (L.) J. R. Laundon (Buck 41811)
Cladonia caespiticia (Pers.) Flörke (Harris 46016; Lay 02-0367)
Cladonia chlorophaea (Sommerf.) Spreng. (Flenniken 5920; Harris 46036)
Cladonia coniocraea (Flörke) Spreng. (Flenniken 5904; Harris 46020)
Cladonia fimbriata (L.) Fr. (Flenniken 5905)
**Cladonia grayi* G. Merr. *ex* Sandst. (Egan 15,920)
Cladonia squamosa Hoffm. (Egan 15,933; Flenniken 5921; Harris 45026. 45973)
Conotrema urceolatum (Ach.) Tuck. (Crane 02-438; Guccion s.n.; Harris 45009)
Cresponea chloroconia (Tuck.) Egea & Torrente (Harris 45986A, 45998, 46047; Lay 02-0056)
****Dactylospora lobariella* (Nyl.) Hafellner (Harris 45970A)
Dimerella lutea (Dickson) Trevisan (Buck 41796)
Dimerella pineti (Ach.) Vězda (Buck 41748, 41754)
****Distopyrenis americana* Aptroot (Harris 45976)
Eopyrenula intermedia Coppins (Harris 46003B)
****Epigloea soleiformis* Döbbeler (Buck 41784, 41802)
Evernia mesomorpha Nyl. (Egan 15,924; Flenniken 5906)
**Evernia prunastri* (L.) Ach. (Guccion s.n.)
Flavoparmelia caperata (L.) Hale (Egan 15,917; Flenniken 5907; Guccion s.n.)
**Flavopunctelia soredica* (Nyl.) Hale (Egan 15,787)
****Fuscidea pusilla* Tønsberg (Buck 41769; Harris 46008)
****Fuscopannaria ahlneri* (P. M. Jørg.) P. M. Jørg. (Buck 41814)
Graphis scripta (L.) Ach. (Bennett 02-0081; Egan 15,938; Harris 45979)
Heterodermia speciosa (Wulfen) Trevisan (Egan 15,934; Flenniken 5908)
Hypogymnia physodes (L.) Nyl. (Bennett 02-0082,02-0083, 02-0084; Flenniken 5922; Guccion s.n.; Lay 02-0380)
****Hypotrachyna revoluta* (Flörke) Hale (Egan 15,936)
**Imshaugia aleurites* (Ach.) S. F. Meyer (Ketzner 2983)
****Lecanora meridionalis* H. Magn. (Buck 41778; Harris 46041)
Lecanora rugosella Zahlbr. (Buck 41805; May 6157)
Lecanora thysanophora R. C. Harris (Guccion s.n.; Harris 45980, 46014, 46017)
Lecanora wisconsinensis H. Magn. (Buck 41765)
Lecidea berengeriana (Massal.) Nyl. [*Mycobilimbia berengeriana* (A. Masal.) Hafellner] (Buck 41779, 41808)
Lepraria lobificans Nyl. (Harris 46004)
Lithothelium hyalosporum (Nyl.) Aptroot (Buck 41749; Harris 45968, 45985, 45986)
****Lithothelium septemseptatum* (R. C. Harris) Aptroot (Harris 45995)
Lobaria pulmonaria (L.) Hoffm. (Buck 41759; Egan 15,908, 15,913; Flenniken 5909; Harris 45025; Lay 02-0381; Majestyk 3057)
Lobaria quercizans Michx. (Egan 15,907; Guccion s.n.; Harris 45970)
Loxospora cismonica (Beltr.) Hafellner (Buck 41773; Guccion s.n.; Harris 46027; May 6156B; Lay 02-0383)
Loxospora elatina (Ach.) A. Massal. (Harris 45982; May 6156A, 6150, 6157)
Loxospora pustulata (Brodo & Culb.) R. C. Harris (Guccion s.n.; Harris 46019, 46035; May 6153)
Melanelia septentrionalis (Lynge) Essl. (Harris 45997)

Melanelia subaurifera (Nyl.) Essl. (Flenniken 5910; Guccion s.n.; Harris 45997A, 46034; Lay 02-0387)
Menegazzia terebrata (Hoffm.) A. Massal. (Bennett 02-0087; Buck 41781; Egan 15,921, 15,931; Flenniken 5923; Ketzner 2981; Lay 02-0063)
Micarea melaena (Nyl.) Hedl. (May 6164)
Micarea peliocarpa (Anzi) Coppins & R. Sant. (Buck 41794, 41803, 41809, 41810; May 6153)
Micarea prasina Fr. (Buck 41735, 41744, 41751, 41756)
Myelochroa aurulenta (Tuck.) Elix & Hale (Harris 45984; Ketzner 2955)
Myelochroa galbina (Ach.) Elix & Hale (Harris 45971, 46007)
****Normandina pulchella* (Borrer) Nyl. (Bennett 02-0088; Buck 41786; Lay 02-0065)
Ochrolechia arborea (Kreyer) Almb. (Bennett 02-0089)
Ochrolechia trochophora (Vainio) Oshio (Buck 41742; Egan 15,906)
****Opegrapha diffracticola* R. C. Harris & D. Ladd (Buck 41783A)
Opegrapha varia Pers. (Buck 41776)
****Opegrapha vulgata* Ach. (Harris 46000)
**Parmelia saxatilis* (L.) Ach. (Flenniken 5924)
Parmelia squarrosa Hale (Egan 15,916; Flenniken 5925, 5926, 5927; Guccion s.n.; Harris 45965)
Parmelia sulcata Taylor (Flenniken 5911, 5912; Guccion s.n.; Harris 45972)
Parmotrema chinense (Osbeck) Hale & Ahti (Harris 46028)
Parmotrema crinitum (Ach.) M. Choisy (Bennett 02-0090; Egan 15,915, 15,918; Flenniken 5928, 5929; Guccion s.n.; Harris 45024, 46031; Ketzner 2982; Lay 02-0393; May 6147)
Peltigera canina (L.) Willd. (Flenniken 5930)
Peltigera didactyla (With.) J. R. Laudon (Crane 02-436)
Peltigera elisabethae Gyelnik (Bennett 02-0091; Harris 46045; Lay 02-0066)
Peltigera horizontalis (Hudson) Baumg. (Egan 15,914)
Pertusaria amara (Ach.) Nyl. (Bennett 02-0092; Buck 41797, 41807; Harris 46040; May 6158)
Pertusaria macounii (Lamb) Dibben (Buck 41741, 41766; Harris 45999)
Pertusaria ophthalmiza (Nyl.) Nyl. (Buck 41804, 41806; Butler 1520d; Harris 46042; May 6156C)
Pertusaria trachythallina Erichsen (Guccion s.n.; Harris 45976A)
Pertusaria velata (Turner) Nyl. (Buck 41737; Guccion s.n.)
Phaeophyscia pusilloides (Zahlbr.) Essl. (Harris 45990)
Phaeophyscia rubropulchra (Degel.) Essl. (Flenniken 5931; Harris 45978, 45989, 46011; Lay 02-0401)
Physcia stellaris (L.) Nyl. (Flenniken 5913)
Physconia detersa (Nyl.) Poelt (Flenniken 5914)
Platismatia tuckermanii (Oakes) Culb. & C. Culb. (Bennett 02-0094; Crane 02-435; Egan 15,909, 15,927; Flenniken 5932; Guccion s.n.; Harris 46023; Ketzner 2970; Lay 02-0406)
Pseudocyphellaria crocata (L.) Vainio (Buck 41815)
Punctelia rudecta (Ach.) Krog (Egan 15,937; Flenniken 5933, 5934; Ketzner 2976; Lay 02-0407)
Punctelia subrudecta (Nyl.) Krog (Egan 15,910, 15,925; Harris 45994, 46032, 46046)
****Pyrenula laevigata* (Pers.) Arnold (Buck 41753, 41762)

Pyxine sorediata (Ach.) Mont. (Egan 15,935; Flenniken 5915; Guccion s.n.; Harris 45964; Ketzner 2980; Lay 02-010, 02-0413)
Ramalina americana Hale (Bennett 02-0095; Egan 15,904; Flenniken 5935, 5936; Guccion s.n.; Harris 46001)
Ramalina dilacerata (Hoffm.) Hoffm. (Kneiper 272)
Rinodina ascociscana Tuck. (Bennett 02-0096; Buck 41758; Harris 46015; Lay 02-0070)
Rinodina degeliana Coppins (Harris 46018A)
Rinodina pachysperma H. Magn. (Butler 1520a)
Rinodina subminuta H. Magn. (Buck 41734, 41750; Harris 45967, 45988B, 46010; Lay 02-0196)
Sphinctrina anglica Nyl. (Buck 41782; Lay 02-0034)
Sphinctrina turbinata (Pers.: Fr.) De Not. (Buck 41761; Lay 02-0036)
****Sticta fuliginosa* (Hoffm.) Ach. (Wetmore 87685)
Strigula stigmatella (Ach.) R. C. Harris (Buck 41788, 41793, 41801, 41813; Lay 02-0418; May 6154)
Trapeliopsis flexuosa (Fr.) Coppins & P. James (Buck 41795)
Trapeliopsis viridescens (Schrad.) Coppins & P. James (Buck 41755, 41771)
Tuckermannopsis americana (Spreng.) Hale (Egan 15,923, 15,969; Flenniken 5916; Guccion s.n.; Harris 45981)
Usnea cavernosa Tuck. (Buck 41791; Guccion s.n.; Harris 46029, 46030)
**Usnea filipendula* Stirton (Flenniken 5937)
****Usnea fulvoreagens* (Räsänen) Räsänen (Harris 46033A, 46039)
Usnea glabrescens (Vainio) Vainio (Harris 46033)
Usnea hirta (L.) F. H. Wigg. (Flenniken 5938)
Usnea subfloridana Stirton (Bennett 02-0097; Flenniken 5939, 5940; Harris 46033B)
Vulpicida pinastri (Scop.) J.-E. Mattsson & M. J. Lai (Kneiper 271; Lücking/Cáceres s.n.)
Xanthoria hasseana Räsänen (Harris 46012)

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Campylopus carolinae Grout in New Jersey

Jean Y. Kekes [1] & William Olson [2]

The State of New Jersey has an interesting moss flora, in part because there are four major physiographic regions present in the State (Karlin 1992). The largest New Jersey physiographic region is the Coastal Plain. Within the Coastal Plain, the New Jersey Pine Barrens covers more than a million acres in central and southern New Jersey.

It is thought the Coastal Plain was originally formed by a cycle of the marine deposition of silts, sands and gravels followed by erosion as the sea withdrew. This cycle is thought to have occurred many times, resulting in layers of varying thicknesses. About 5 million years ago, the land uplifted and the sea retreated for the last time, leaving the most recent depositions on the surface. This soil tends to be sandy and somewhat acidic.

The advent of glacial activity seems to have affected the climate, but not the composition of the soil itself. Indeed the last of the Wisconsin ice stopped short of the Pinelands altogether. However, during this period of glaciation, the coast line was far to the east of where it presently lies, affording a vast migratory area for flora from both north and south. Thus, the flora exhibits a great number of northern species at their southernmost limits and a great number of southern species at their northernmost limits. In addition, both flora and fauna present many instances of disjunct species.

On a recent field trip to the Pine Barrens, we found *Campylopus carolinae* Grout in well-drained sandy soil in an area of shifting sands site rife with *Corema conradii* (Torr.) Torr. *ex* Loud, *Pinus rigida* P. Mill, and *Quercus marilandica* Muenchh. The plants of *C. carolinae*, at least at that moment, were not buried in the sand, and the tips were oncolorous. This appears to be the first report of the genus *Campylopus* in New Jersey (see Karlin & Schaffroth 1992). The genus, however, is known from nearby Delaware (Allen 1990). *Campylopus carolinae* has been reported from northern North Carolina to Central Georgia and Cuba (Crum & Anderson 1981), but there are at MO collections of the species from southern Virginia (Isle Wight County) and Florida. The New Jersey station of *C. carolinae* thus represents a considerable northern range extension.

Campylopus carolinae Grout, New Jersey, Ocean County, Little Egg Harbor Township, U. S. Naval Reservation, Warren Grove Target Area, Lower Plains,4.4 km south of Warren Grove, on dwarf pitch pine plains off a sand road, 39°42'25"N 74°22'32"W *Jean Kekes* #3001(MO, PH, NY).

We thank Bruce Allen for verifying the identity of this collection.

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New Records for *Myelochroa metarevoluta* (Asahina) Hale in Ohio

Don G. Flenniken [1]

Myelochroa metarevoluta was first described by Y. Asahina from Japan in 1960 (Asahina 1960). North American records were first reported by M. Hale (Hale 1976) in his revision of the lichen genus *Parmelina.* At that time, Hale cites three North American collections, one from Maryland (Plitt 236), one from Tennessee (Nakanishi 238) and one from Ohio (Wetmore 18051), each in Herbarium US. One additional collection is known; that of Skorepa from Montgomery County, Maryland in 1977. Records from West Virginia (Flenniken 1999) are in error. Hale (1976) states that this species is, "… extremely rare in North America".

A specimen collected 9 March 2003 (Lund 502) from Shawnee State Forest, Nile Township, Scioto County, Ohio was confirmed as *Myelochroa metarevoluta* by Dr. Theodore Esslinger. TLC analysis confirmed galbinic acid, 3-H Terpenoids, and atranorin (TLC 466-5, Essl.). As pointed out by Kurokawa (1968), this is the sorediate morph of [*Myelochroa*] *galbina.* Dr. Esslinger also confirmed the presence of moniliform cells, like those found in *M. galbina,* in the medulla (personal communication). Additional specimens have now been found from Adams and Highland Counties in southern Ohio.

Specimens were collected from a variety of hardwood trees, including *Acer rubrum, Catalpa speciosa, Carya ovata, Cercis canadensis, Fraxinus americana, Liriodendron tulipifera, Quercus alba, Quercus coccinea,* and *Robinia pseudoacacia*, on standing living and dead trees and from wind-thrown trees downed by a February 2003 ice storm.

Myelochroa metarevoluta may be more common than originally thought and should be looked for on the lower trunks of hardwood trees in open, mesic, oak/hickory forests.

Specimens Examined: **Ohio:** Adams County, Edge of Appalachia Preserve, Lund #552; Highland County, Highland Nature Sanctuary, Lund #504; and Scioto County, Shawnee State Forest, Lund #502, Shawnee State Park, Lund #551, #562, #563, #565, #566, #567, #568, #569, and #570.

Acknowledgments: I would like to thank Barbara A. Lund (Lynx, Ohio) for collecting and providing specimens of *Myelochroa metarevoluta*, Ray E. Showman (American Electric Power) for forwarding the initial specimens for examination, and Dr. Theodore L. Esslinger (North Dakota State University) for TLC analysis of the chemical constituents and for verification of the initial identification.

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A new name for the eastern North American species of *Ctenidium*

William R. Buck[1] and Bruce H. Allen[2]

The moss genus *Ctenidium* is well characterized by the differentiated branch and stem leaves, and by the falcate, decurrent leaves with a short, double costa, toothed margins, weakly differentiated alar cells, and prorulose laminal cells. Traditionally (e.g., Crum & Anderson, 1981), all material in eastern North America was called *Ctenidium molluscum* (Hedw.) Mitt., based on a European type. However, when the genus was monographed by Nishimura (1985), he restricted the use of the name *C. molluscum* primarily to European material, and to material from Alaska. All eastern North American material was relegated to the name *C. malacodes* Mitt., based on a type from Colombia. More recently, Pedano (1996) proposed that collections from eastern North American are different from South American material. He suggested that the oldest available epithet for eastern North American material was *Hypnum subrectifolium* Brid., but failed to make a valid combination. Regardless of whether the eastern North American material and that from South America are the same, presuming that Nishimura was correct in excluding *C. molluscum* from the region, then the oldest available name for this taxon in eastern North America is *Hypnum subrectifolium* (1827) which predates *C. malacodes* (1869). We now need use of the proper name for various flora projects in progress, as well as for an updated checklist of North American mosses. Therefore, we take this opportunity to make the combination.

Ctenidium subrectifolium (Brid.) G. Pedano *ex* W. R. Buck & B. H. Allen, comb. nov.

Hypnum subrectifolium Brid., Bryol. Univ. 2: 619. 1827. Type: "in sylvis Provinciae Massachusets prope Noveboracum lectum D. Torrey misit." Lectotype (designated here): fertile stem at B!

The type specimen at Berlin is a single sheet with two labels on it, with 5 small patches of sterile moss glued to the sheet above the upper label, and a single fertile stem glued above the lower label. The upper label appears to be the older, and the lower label a copy of it (by Bridel). However, all the material appears to be part of a single gathering by John Torrey (i.e., D[r]. Torrey) from New York (Noveboracum).

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The protologue by Bridel (1827) mentions the sporophyte, lending more credence to this hypothesis. There is nothing on the label that gives any indication of Massachusetts, and it may have just been a geographical misunderstanding by Bridel that resulted in his mention of Massachusetts, unless it was included in a letter, now long-lost.

Acknowledgement. We thank Dr. Heidemarie Nowak-Krawietz, curator of bryophytes at the Herbarium of the Botanischer Garten und Botanisches Museum Berlin-Dahlem, for promptly sending on loan the critical Bridel specimen.

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A Second Location for the Rare Boreal Felt Lichen in Nova Scotia

Robert Cameron [1]

The boreal felt lichen (*Erioderma pedicellatum* (Hue) P.M.Jorg.) has been cited as one of the rarest and most endangered lichens in the northern hemisphere (Clayden 1997). The world population of this lichen has been listed as critically endangered by IUCN and the Atlantic population listed as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). A new record brings the total known locations of this species to two in Nova Scotia.

The boreal felt lichen is one of a group known as the cyanolichens. The photosynthetic partners of cyanolichens are cyanobacterium, unlike other lichens in which algae are the photosynthetic partners. The felt lichen is foliose in form, i.e. somewhat leafy appearance. The lichen is normally gray brown when dry, to slate blue when wet. There is a covering of fine white hairs on both the lower and upper surface. Reproductive structures, known as apothecia, look like tiny dark coloured cups on the upper surface of mature individuals.

Boreal felt lichen is known to occur in humid, oceanic coniferous forest. Typically occurring on balsam fir, it can occasionally be found on black spruce or red maple (MacGregor *et al.* 2003, Robertson 1998). Historically the felt lichen was found in Scandinavia, Newfoundland and Maritime Canada (Clayden 1997).

Currently the felt lichen is found in only a few locations. The Newfoundland population appears to be the largest and healthiest and although new sites are being found, few of the original sites still have felt lichen (Robertson 1998). Quite likely, it is extirpated from New Brunswick as surveys by lichenologists Stephen Clayden and Wolfgang Maass have failed to reveal its' presence. Only one location in Scandinavia still known to exist (Holien *et al.* 1995).

Wolfgang Maass has been studying boreal felt lichen and many of its associated species for decades. Just two decades ago, Dr. Maass identified 40 locations where the felt lichen was found. Today only one of the original locations still has the lichen. All 39 other sites no longer have boreal felt lichen (MacGregor *et al.* 2003). It is largely Dr. Maass' work that led to the COSEWIC listing.

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Disappearance of the boreal felt lichen is attributed to acid rain and habitat destruction (Goward *et al.* 1998). Like many other cyanolichens, boreal felt lichen is very sensitive to acid rain. It may be more sensitive to acid rain than other cyanolichens because it inhabits an already acid environment, boreal coniferous forest. The lichen often grows on commercial species of trees and therefore is subject to habitat destruction through tree harvesting.

The finding is the result of systematic surveying of the Tangier Grand Lake Wilderness Area using Geographical Information System maps of likely habitat, generated by the Nova Scotia Department of Environment and Labour. Only a few of the most likely habitats were surveyed and it is quite possible additional thalli will be found. I found four thalli, three mature and one juvenile, on a mature balsam fir in a mature balsam fir-black spruce forest. No voucher specimen was taken because of the rarity of this species. Fortunately the newly located specimens are safe from commercial tree harvesting and development within an existing protected area. The Tangier Grand Lake Wilderness Area is a 16,000 ha area, protected through the Nova Scotia Wilderness Areas Protection Act.

As a result of the COSEWIC listing, an Atlantic Canada boreal felt lichen workshop was convened in the fall of 2002. Stemming from the workshop, a Maritime cyanolichen status assessment team was formed to assess the potential threats to other cyanolichens. As well, an information pamphlet and an identification card were published by the Nova Scotia Department of Natural Resources and Environment Canada to help raise awareness of the boreal felt lichen. The boreal felt lichen was listed under the Nova Scotia Endangered Species Act in October 2003.

Although there have been a few positive steps locally toward recovering the boreal felt lichen, the largest problem is acid rain. Much of Nova Scotia's acid rain problem stems from transboundary sulfur dioxide and nitrous oxide from the US and central Canada. Until acid rain is reduced the boreal felt lichen will be at risk.

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Additional county records and confirmations to the moss flora of Ohio

John J. Atwood & Carl F. Chuey

Years of localized collecting have produced an incomplete perspective of the distribution of mosses throughout Ohio. Neighboring counties often widely differ in their reported number of taxa, creating distribution gaps, one of which extends along the panhandle border of West Virginia and the Ohio line (Snider and Andreas 1996). Overall, 22 counties were included in the study yielding 122 taxa with 271 new and 144 confirmed county records based upon the holdings of the Herbarium of Youngstown State University (YUO). No new state records were added.

The nomenclature used follows that of Anderson (1990) and Anderson *et al.* (1990). Taxa are listed alphabetically by family. A *NC* after the accession number represents a new county record whereas *RC* is a reported confirmation. The studied Ohio counties are given in three-letter abbreviations: ASH-Ashtabula, ASL-Ashland, ATH-Athens, BEL-Belmont, CAR-Carroll, COL-Columbiana, CUY-Cuyahoga, ERI-Erie, GRE-Greene, HAR-Harrison, JEF-Jefferson, LUC-Lucas, MAH-Mahoning, MED-Medina, NOB-Noble, OTT-Ottawa, PIK-Pike, POR-Portage, STA-Stark, SUM-Summit, TRU-Trumbull, VIN-Vinton.

Amblystegiaceae

Amblystegium serpens (Hedw.) Schimp. *in* B.S.G. var. *serpens* ATH-3287 *RC*, COL-61746 *NC*, HAR-83536 *NC*, MAH-14617 *NC*, TRU-16811 *NC*

Amblystegium serpens var. *juratzkanum* (Schimp.) Rau & Herv. ASH-61655 *NC*

Amblystegium varium (Hedw.) Lindb. ASH-61720 *NC*, ATH-3200 *RC*, CAR-83526 *NC*, JEF-83421 *NC*, MAH-61568 *RC*, TRU-16811 *RC*

Campylium chrysophyllum (Brid.) J. Lange MAH-61596 *NC*, NOB- 83482 *NC*, TRU-45857 *NC*

Campylium polygamum *(Schimp.* in *B.S.G.) C. Jens. MED-39374* NC

Cratoneuron filicinum *(Hedw.) Spruce ASH-15440* NC

Hygroamblystegium tenax *(Hedw.) Jenn. var.* tenax *ASH-14696* NC, *CAR-83523* RC, *COL-39381* NC, *MED-39380* NC, *NOB-83512* NC

Leptodictyum riparium (Hedw.) Warnst. JEF-83417 *NC*, MED-83517 *NC*

Anomodontaceae

Anomodon attenuatus (Hedw.) Hüb. ASH-14620 *RC*, ATH-3235 *RC*, CAR-83522 *NC*, COL-83456 *NC*, JEF-45889 *NC*, MAH-39377 *NC*, TRU-61892 *RC*

Anomodon rostratus (Hedw.) Schimp. ATH-3234 *RC*, COL-82322 *NC*, HAR-83541 *NC*, MAH-79733 *NC*, SUM-61580 *RC*

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Aulacomniaceae

Aulacomnium heterostichum (Hedw.) Bruch & Schimp. *in* B.S.G. ATH-80056 *RC*, COL-61739 *NC*

Aulacomnium palustre (Hedw.) Schwaegr. MAH-39393 *NC*, NOB-61868 *NC*, TRU-66473 *RC*

Bartramiaceae

Bartramia pomiformis Hedw. ATH-3242 *RC*

Brachytheciaceae

Brachythecium acuminatum (Hedw.) Aust. ASH-14625 *RC*, MAH-39439 *NC*, TRU-56622 *RC*, SUM-80057 *RC*

Brachythecium oxycladon (Brid.) Jaeg. ASH-14627 *NC*, CAR-83521 *NC*, COL-83452 *NC*, HAR-83549 *NC*, JEF-83407 *NC*, MAH-66291 *NC*, NOB-79620 *NC*, TRU-79545 *NC*

Brachythecium rivulare Schimp. *in* B.S.G. COL-61755 *NC*, MAH-45917 *NC*

Brachythecium rutabulum (Hedw.) Schimp. *in* B.S.G. ASH-79559 *RC*, COL-83461 *NC*, MAH-39433 *RC*, MED-83516 *NC*, STA-79546 *NC*, TRU-66510 *RC*

Brachythecium salebrosum (Web. & Mohr) Schimp. *in* B.S.G. var. *salebrosum* HAR-83546 *NC*, JEF-83406 *NC*, MAH-61595 *NC*, NOB-79620 *NC*, SUM-61634 *RC*, TRU-66468 *NC*

Bryhnia graminicolor (Brid.) Grout SUM-61633 *NC*

Bryhnia novae-angliae (Sull. & Lesq. *in* Sull.) Grout CAR-83519 *NC*, COL-61743 *RC*, JEF-83419 *NC*, MAH-45924 *NC*, TRU-66541 *RC*

Bryoandersonia illecebra (Hedw.) Robins. ASH-61661 *RC*, ATH-3245 *RC*, COL-83439 *NC*, HAR-83545 *NC*, JEF-45867 *NC*, MAH-39772 *NC*, NOB-79621 *NC*, TRU-56620 *NC*

Eurhynchium hians (Hedw.) Sande Lac. ASH-61673 *NC*, ATH-3247 *RC*, COL-61733 *NC*, HAR-83554 *NC*, MAH-45859 *NC*, NOB-83511 *NC*, TRU-66469 *RC*

Eurhynchium pulchellum (Hedw.) Jenn. var. *pulchellum* NOB-83510 *NC*

Platyhypnidium riparioides (Hedw.) Dix. JEF-83412 *NC*, TRU-79544 *NC*

Steerecleus serrulatus (Hedw.) Robins. ASH-14688 *RC*, ATH-3311 *RC*, COL-61741 *RC*, HAR-83567 *NC*, JEF-83393 *NC*, MAH-45918 *NC*, MED-83514 *NC*, NOB-83483 *NC*, TRU-16829 *RC*, VIN-3309 *RC*

Bruchiaceae

Bruchia flexuosa (Sw. *ex* Schwaegr.) C. Müll. MAH-83450 *NC*, TRU-15439 *NC*

Bryaceae

Bryum argenteum Hedw. ATH-3240 *RC*, CUY-79922 *RC*, MAH-61957 *NC*, TRU-66488 *RC*

Bryum caespiticium Hedw. COL-61747 *NC*, MAH-5508 *RC*, TRU-56621 *NC*

Bryum dichotomum Hedw. JEF-83420 *NC*

Bryum lisae var. *cuspidatum* (Bruch & Schimp. *in* B.S.G.) Marg. COL-83435 *RC*, MAH-83503 *NC*, MED-83515 *NC*, TRU-61638 *NC*.

Leptobryum pyriforme (Hedw.) Wils. ATH-3286 *RC*, MAH-14662 *NC*

Pohlia nutans (Hedw.) Lindb. ASH-14693 *NC*, ATH-52232 *RC*, MAH-14694 *NC*, TRU-16814 *RC*

Buxbaumiaceae

Buxbaumia aphylla Hedw. TRU-16823 *NC*

Diphyscium foliosum (Hedw.) Mohr. COL-83444 NC

Climaciaceae

Climacium americanum Brid. ASH-61713 *NC*, ATH-3243 *RC*, COL-37752 *NC*, GRE-14538 *NC*, HAR-83544 *NC*, MAH-16062 *NC*, SUM-61597 *RC*, TRU-64420 *RC*

Dicranaceae

Brothera leana (Sull.) C. Müll. COL-83437 *NC*, MAH-45935 *NC*

Dicranella heteromalla (Hedw.) Schimp. ASH-14548 *RC*, COL-61621 *RC*, CUY-61588 *RC*, MAH-14552 *RC*, TRU-16821 *RC*, VIN-3257 *RC*

Dicranella varia (Hedw.) Schimp. MAH-3252 *NC*

Dicranum flagellare Hedw. ASH-61727 *NC*, COL-83455 *NC*, TRU-61628 *RC*

Dicranum fulvum Hook. ASH-61675 *RC*, COL-83431 *RC*, JEF-82365 *NC*, MAH-66287 *NC*, VIN-3259 *RC*

Dicranum montanum Hedw. COL-56580 *NC*, MAH-25131 *NC*, TRU-83535 *NC*, VIN-3258 *RC*

Dicranum scoparium Hedw. ASH-61716 *RC*, ATH-3260 *RC*, COL-14555 *NC*, MAH-45900 *NC*, TRU-64425 *RC*

Dicranum viride (Sull. & Lesq. *in* Sull.) Lindb. COL-56580 *NC*, JEF-83402 *NC*

Rhabdoweisia crispata (With.) Lindb. TRU-45866 *NC*

Ditrichaceae

Ceratodon purpureus (Hedw.) Brid. var. *purpureus* ASH-61659 *RC*, ATH-3246 *RC*, HAR-83543 *NC*, JEF-83423 *NC*, MAH-61913 *RC*, TRU-56610 *RC*

Ditrichum pallidum (Hedw.) Hampe ASH-14561 *NC*, COL-61939 *NC*, MAH-39395 *NC*, NOB-3256 *RC*, TRU-15436 *RC*

Entodontaceae

Entodon cladorrhizans (Hedw.) C. Müll. COL-83471 *NC*, HAR-83553 *NC*, JEF-83399 *NC*, MAH-39373 *NC*, TRU-39779 *NC*

Entodon seductrix (Hedw.) C. Müll. ASH-14607 *NC*, ATH-3239 *RC*, COL-61528 *NC*, JEF-83410 *NC*, MAH-45909 *NC*, TRU-79570 *RC*

Fissidentaceae

Fissidens adianthoides Hedw. ASH-14668 *RC*, COL-83464 *NC*

Fissidens exilis Hedw. MAH-39425 *NC*

Fissidens taxifolius Hedw. ASH-61728 *NC*, ATH-3264 *RC*, COL-61742 *NC*, HAR-83552 *NC*, JEF-83447 *NC*, MAH-45902 *NC*, TRU-61589 *NC*

Fontinalaceae

Fontinalis dalecarlica Schimp. *in* B.S.G. MAH-3269 *NC*

Fontinalis novae-angliae Sull. var. *novae-angliae* PIK-3268 *NC*

Funariaceae

Funaria hygrometrica Hedw. ASH-14686 *RC*, ATH-3267 *RC*, COL-61749 *NC*, JEF-83413 *NC*, MAH-3272 *NC*, TRU-62010 *RC*

Physcomitrium pyriforme (Hedw.) Hampe JEF-83395 *NC*, MAH-49722 *NC*, NOB-3303 *NC*, TRU-15435 *RC*

Grimmiaceae

Schistidium apocarpum (Hedw.) Bruch & Schimp. *in* B.S.G. ATH-3274 *RC*

Schistidium rivulare (Brid.) Podp. var. *rivulare* ASH-14681 *RC*, COL-83443 *NC*, HAR-83565 *NC*, JEF-83396 *NC*, MAH-83509 *NC*, NOB-83479 *NC*, TRU-66501 *RC*

Helodiaceae

Helodium blandowii (Web. & Mohr) Warnst. var. *blandowii* ASH-61730 *NC*

Helodium paludosum (Sull.) Aust. ATH-3278 *NC*

Hylocomiaceae

Pleurozium schreberi (Brid.) Mitt. NOB-79654 *NC*

Hypnaceae

Callicladium haldanianum (Grev.) Crum ASH-61723 *RC*, COL-45892 *NC*, JEF-83400 *NC*, HAR-83542 *NC*, MAH-14614 *NC*, SUM-61616 *RC*, TRU-45862 *RC*

Ctenidium malacodes Mitt. ASH-61690 *RC*, ATH-3281 *RC*

Homomallium adnatum (Hedw.) Broth. ASH-61726 *RC*, OTT-14618 *RC*, TRU-66516 *NC*

Hypnum curvifolium Hedw. ASH-14610 *NC*, ATH-3280 *RC*, COL-83463 *NC*, JEF-83405 *NC*, MAH-40438 *NC*, TRU-66536 *RC*

Hypnum imponens Hedw. ASH-14612 *RC*, COL-83466 *NC*, MAH-45927 *NC*, TRU-66497 *RC*

Hypnum lindbergii Mitt. CUY-61601 *RC*, MAH-14615 *NC*, NOB-83484 *NC*, TRU-66498 *NC*

Isopterygiopsis muelleriana (Schimp.) Iwats. ATH-3307 *RC*, COL-61734 *NC*

Isopterygium tenerum (Sw.) Mitt. ATH-3308 *NC*

Platygyrium repens (Brid.) Schimp. *in* B.S.G. ASH-14628 *RC*, ATH-3306 *RC*, COL-61590 *NC*, HAR-83556 *NC*, JEF-83392 *NC*, MAH-79547 *NC*, NOB-79634 *RC*, TRU-66480 *RC*

Pseudotaxiphyllum elegans (Mitt.) Iwats. COL-83441 *NC*, TRU-66531 *NC*

Pylaisiadelpha tenuirostris (Bruch & Schimp. *in* Sull.) Buck ASH-14606 *RC*, MAH-14608 *NC*

Taxiphyllum deplanatum (Bruch & Schimp. *ex* Sull.) Fleisch. ASH-14630 *NC*, ATH-3310 *RC*, COL-61736 *NC*, JEF-61750 *NC*

Leskeaceae

Haplocladium microphyllum (Hedw.) Broth. COL-83433 *NC*, HAR-83550 *NC*, TRU-82182 *NC*

Leskea gracilescens Hedw. ASH-61673 *NC*, ATH-3285 *RC*, CAR-83520 *NC*, HAR-83551 *NC*, JEF-83488 *NC*, NOB-79642 *NC*, TRU-66522 *NC*

Leskea polycarpa Hedw. *COL-61754* NC, *MAH-45861* NC, *TRU-66477* RC

Leucobryaceae

Leucobryum glaucum (Hedw.) Ångstr. *ex* Fries. ASH-14664 *RC*, ATH-3284 *RC*, COL-46874 *NC*, MED-39366 *NC*, MAH-46891 *RC*, TRU-14663 *RC*

Mniaceae

Mnium hornum Hedw. ASH-61657 *NC*, TRU-79607 *NC*

Mnium stellare Hedw. ATH-3291 *NC*, COL-83473 *NC*, TRU-16603 *NC*

Plagiomnium ciliare (C. Müll.) T. Kop. ASH-16044 *RC*, BEL-61608 *RC*, COL-61760 *NC*, HAR-83559 *NC*, JEF-83404 *NC*, MAH-66285 *NC*, TRU-55592 *RC*

Plagiomnium cuspidatum (Hedw.) T. Kop. ASH-14595 *RC*, ASL-3292 *NC*, ATH-3293 *RC*, CAR-66296 *RC*, COL-61775 *RC*, HAR-83560 *NC*, JEF-83401 *NC*, MAH-79581 *NC*, NOB-79649 *NC*, TRU-79580 *RC*

Rhizomnium punctatum (Hedw.) T. Kop. ASH-14597 *RC*, COL-56584 *NC*, JEF-45865 *NC*, MAH-39391 *NC*, TRU-83530 *RC*, VIN-3294 *NC*

Orthotrichaceae

Orthotrichum stellatum Brid. MAH-82187 *NC*

Orthotrichum pumilum Sw. ATH-3296 *NC*, COL-83442 *NC*, JEF-45944 *NC*

Orthotrichum strangulatum P. Beauv. ATH-3295 *RC*

Ulota crispa (Hedw.) Brid. ASH-14673 *RC*, COL-83446 *NC*, HAR-83555 *NC*

Plagiotheciaceae

Plagiothecium cavifolium (Brid.) Iwats. ASH-61689 *RC*, COL-61735 *NC*, MAH-61815 *NC*, TRU-66533 *NC*

Plagiothecium denticulatum (Hedw.) Schimp. *in* B.S.G. COL-83454 *NC*, MAH-45919 *NC*, TRU-15437 *RC*

Plagiothecium laetum Schimp. *in* B.S.G. ASH-14631 *NC*, COL-56583 *NC*

Polytrichaceae

Atrichum angustatum (Brid.) Bruch & Schimp. *in* B.S.G. ASH-14636 *RC*, ATH-3233 *RC*, CAR-83524 *RC*, COL-61757 *RC*, HAR-83540 *NC*, JEF-45897 *NC*, LUC-79533 *RC*, MAH-45871 *RC*, NOB-79647 *RC*, SUM-61606 *NC*, TRU-56604 *RC*

Atrichum oerstedianum (C. Müll.) Mitt. JEF-62199 *NC*, TRU-45874 *NC*

Atrichum tenellum (Röhl.) Bruch & Schimp. *in* B.S.G. ATH-3255 *NC*

Atrichum undulatum (Hedw.) P. Beauv. (*sensu lato*) CUY-61567 *RC*, MAH-39406 *NC*, TRU-16824 *RC*

Pogonatum pensilvanicum (Hedw.) P. Beauv. ASH-14640 *NC*, ATH-3318 *RC*, COL-83469 *NC*

Polytrichum commune Hedw. var. *commune* ASH-61706 *RC*, ATH-3298 *RC*, COL-39736 *NC*, JEF-83425 *NC*, MAH-39767 *NC*, SUM-79593 *NC*, TRU-45878 *RC*

Polytrichum juniperinum Hedw. VIN-3299 *RC*

Polytrichum ohioense Ren. & Card. ASH-14645 *RC*, COL-61530 *RC*, MAH-14647 *NC*, MED-39428 *NC*, POR-45899 *RC*, TRU-15436 *RC*

Polytrichum pallidisetum Funck MAH-61997 *NC*

Pottiaceae

Barbula unguiculata Hedw. JEF-83415 *NC*, MAH-45882 *NC*, MED-83518 *NC*, TRU-45868 *NC*

Gymnostomum aeruginosum Sm. ASH-14680 *NC*

Hymenostylium recurvirostre (Hedw.) Dix. MAH-83451 *RC*

Phascum cuspidatum Hedw. MAH-83449 *NC*

Pottia truncata (Hedw.) Fürnr. *ex* B.S.G. MAH-83448 *NC*

Tortella humilis (Hedw.) Jenn. JEF-83414 *NC*

Weissia controversa Hedw. ASH-14682 *NC*, ATH-3314 *RC*, MAH-45942 *NC*

Sematophyllaceae

Brotherella recurvans (Michx.) Fleisch. ASH-14677 *RC*, MAH-25125 *NC*

Sematophyllum demissum (Wils.) Mitt. ASH-61696 *RC*, COL-83470 *NC*, JEF-83398 *NC*, MAH-61970 *NC*, TRU-66525 *NC*

Sphagnaceae

Sphagnum affine Ren. & Card. MAH-66254 *NC*, TRU-3320 *NC*

Sphagnum capillifolium (Ehrh.) Hedw. TRU-16817 *NC*

Sphagnum cuspidatum Ehrh. *ex* Hoffm. MAH-5836 *NC*

Sphagnum fallax (Klinggr.) Klinggr. MAH-39400 *NC*

Sphagnum fimbriatum Wils. *in* Wils. & Hook. *f.* *in* Hook. *f.* var. *fimbriatum* JEF-11463 *NC*, MAH-66256 *NC*, TRU-14582 *NC*

Sphagnum girgensohnii Russ. JEF-14583 *NC*

Sphagnum magellanicum Brid. TRU-16820 *NC*

Sphagnum palustre L. MAH-46893 *NC*, TRU-61789 *NC*

Sphagnum papillosum Lindb. ASH-14585 *NC*

Sphagnum recurvum P. Beauv. MAH-2714 *NC*

Sphagnum subsecundum Nees. *in* Sturm var. *subsecundum* ERI-2126 *NC*, MAH-5809 *NC*, TRU-9052 *NC*

Tetraphidaceae

Tetraphis pellucida Hedw. ASH-14690 *RC*, ATH-3313 *RC*, COL-83468 *NC*, TRU-55588 *RC*

Thamnobryaceae

Thamnobryum alleghaniense (C. Müll.) Nieuwl. ATH-3305 *RC*

Theliaceae

Thelia asprella Sull. *in* Sull. & Lesq. VIN-3317 *RC*

Thuidiaceae

Cyrto-hypnum minutulum (Hedw.) Buck & Crum ATH-3316 *NC*

Thuidium delicatulum (Hedw.) Schimp. *in* B.S.G. ATH-3315 *RC*, CAR-83527 *NC*, COL-40434 *NC*, CUY-61618 *RC*, HAR-83564 *NC*, JEF-62198 *NC*, MAH-46888 *NC*, NOB-83480 *NC*, SUM-61619 *RC*, TRU-16604 *RC*

Thuidium recognitum (Hedw.) Lindb. NOB-61921 *NC*, TRU-66493 *NC*

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Volume 21 Number 2

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The Bryophyte Taxa of New Hampshire

Natalie L. Cleavitt [1]

This is the first list including all three bryophyte Phyla for the state and although inevitably incomplete, it should serve as a solid base to which collection records can be added and eventually rarity of bryophyte species in the state can be reliably assessed. The checklist for *Sphagnum* in New Hampshire has been previously published (Cleavitt et al. 2001) and the genus is not included here. This checklist includes specimens verified by the author or by Allen (1992), as well as, a small Appendix of reliable literature citations for specimens that I have not been able to track down. New Hampshire is home to 3 genera and 4 species of hornworts, 52 genera and 145 species of liverworts (plus 2 genera and 8 species in Appendix) and 137 genera and 363 species of mosses (including 43 species of *Sphagnum* (Cleavitt et al. 2001)) (plus 5 genera and 9 species in Appendix). The present species richness for bryophytes in the state is 512 species (529 with Appendix species). Approximately 90 of these species (mainly mosses) have not been reported as occurring in the state previously (e.g., Allen 1992 and references cited therein, Evans 1923). Of the 529 species, 136 (25%) have only one collection record to verify their occurrences in the state and 62% of these rare species are only known from historical (pre-1920) collections.

Collection efforts in the state have been biased toward the White Mountain region as evidenced by the distribution of collection records reported here by county (number of records in parentheses): Belknap (52), Carroll (131), Cheshire (93), Coös (342), Grafton (327), Hillsborough (86), Merrimack (117), Rockingham (43), Strafford (71) and Sullivan (54). The urgency for collections in southern counties of Rockingham and Sullivan cannot be overemphasized given the current paucity of collections and the exponential rate of development recorded for this area of the state (Thorne & Sundquist 2001). Belknap and Strafford counties also remain particularly undercollected areas.

Allen (1992) and Evans (1923) served as the starting points for this list. Many of the moss specimens that were verified by Allen (1992) are retained here as indicated by herbarium deposition in Missouri Botanical Garden (MO) or University of Maine (MAINE). The Evans (1923) list was for all of New England and did not list county records.

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The present amalgamation and expansion of New Hampshire bryophyte checklist is the result of several years of herbarium searching, specimen annotation and collecting that took place mainly from 1994-1996 with added records from specimen identifications for the New Hampshire Natural Heritage Program (1996-2002). Important historical collectors in the state include Alexander Evans, Annie Lorenz, Clara Cummings, Caroline Haynes, William Farlow, Temple Clayton, A. LeRoy Andrews, A.J. Grout, and Ethel Hutchinson. Important contemporary collectors include Bruce Allen, Norton Miller, Daniel Sperduto and R.M. Schuster.

All collections are deposited in Bailey Hortorium (BH) at Cornell University unless otherwise indicated. Collections are listed by county except when the location information was too vague (e.g., White Mountains). Collection numbers without a collector name are those of the author. If a collection number was not available for a specimen, then the collection year is provided and set off by a comma. For each county only one unique collection reference is given. However, widely distributed historical collections are retained and a more recent specimen is cited when available.

Herbaria consulted: Cornell University (BH), University of New Hampshire (NHA), Dartsmouth University (HNH), Duke University (DUKE), New York Botanical Garden (NY), Yale University (YU), Harvard University (FH), New England Botanical Club (NEBC), New York State Museum (NYS), Michigan Technical University (MCTC) and Chicago Field Museum of Natural History (F). Nomenclature follows Schuster (1969-1992) for hornworts and liverworts and Crosby et al. (1999) for mosses.

ANTHOCEROPHYTA

Anthocerotae

Aspiromitus macounii (Howe.) Schust.: GRAFTON (Lorenz, 1917, NY)

A. punctatus (L.) Schljakov: GRAFTON (Lorenz, 1917, NY); SULLIVAN (Haynes 723c, YU)

Phaeceros laevis subsp. *carolinianus* (L.) Schust.: COÖS (Evans, 1917,YU); GRAFTON (Hutchinson, 1966, NY); STRAFFORD (Lane 1971, NHA)

Notothylaceae

Notothylas orbicularis (Schwein.) Sull.: GRAFTON (Lorenz, 1917, YU); SULLIVAN (Haynes, 1904, NY)

HEPATOPHYTA

Aneuraceae

Aneura pinguis (L.) Dum.: CARROLL (Smith & Miller 35693, NYS); COÖS (Evans, 1917, YU); GRAFTON (Lorenz, 1910, YU); MERRIMACK (974)

Riccardia latifrons (Lindb.) Lindb.: CARROLL (1329b); COÖS (Rel. Farlow. 526); GRAFTON (698a)

R. multifida (L.) S. F. Gray: CARROLL (Miller 2157, NYS); CHESHIRE (Rel. Farlow. 527); COÖS (Underwood & Cook, Hep. Am. 45); GRAFTON (Miller 1010, NYS)

R. palmata (Hedw.) Carr.: COÖS (Schuster 74-2850d, F); GRAFTON (Hutchinson 1950)

Aytoniaceae

Asterella tenella (L.) P. Beauv.: GRAFTON (Hutchinson 269)

Reboulia hemisphaerica (L.) Raddi.: STRAFFORD (Randle, 1961, NHA); SULLIVAN (Haynes, 1904, YU)

Blasiaceae

Blasia pusilla (L.) Micheli.: BELKNAP (Carter, 1890); CARROLL (Andrews, 1915); COÖS (Miller 995, NYS); GRAFTON (708); MERRIMACK (Andrews, 1915); SULLIVAN (1476)

Calypogeiaceae

Calypogeia fissa subsp. *neogaea* Schust.: COÖS (Evans, 1917, YU); GRAFTON (Lorenz 1917, YU; 1340)

C. intergristipula Steph.: COÖS (Evans, 1917, YU); GRAFTON (1379)

C. muelleriana (Schiffn.) Müll.: CARROLL (Farlow, 1904,YU); CHESHIRE (953); COÖS (Evans, 1917,YU; 1254); GRAFTON (1395); HILLSBOROUGH (781b); MERRIMACK (1484); ROCKINGHAM (Sperduto 4913)

C. neesiana (Mass. & Carest.) K. Müll.: CARROLL (1349a); COÖS (Schuster 68-2132); GRAFTON (Evans, 1911, YU); ROCKINGHAM (1508)

C. sphagnicola (Arnell & Perss.) Warnst. & Loeske.: CARROLL (Evans et al., 1908, YU); CHESHIRE (Lorenz, 1915, YU); GRAFTON (Evans et al., 1908, YU)

C. suecica (Arnell & Perss.) K. Müll.: COÖS (Evans, 1917, YU); GRAFTON (Evans et al., 1908, YU)

C. sullivantii Aust.: COÖS (Evans, 1917, YU); SULLIVAN (Haynes, 1911, YU)

C. trichomanis (L.) Corda.: COÖS (1271); GRAFTON (Lorenz 463, YU; 1388)

Metacalypogeia schusterana Hatt. et Mitzut.: COÖS (995)

Cephaloziaceae

Cephalozia bicuspidata (L.) Dum.: CARROLL (Farlow, 1904, YU); CHESHIRE (Greenwood, 1925, YU, Miller 5644, NYS); COÖS (1257); GRAFTON (710)

C. bicuspidata subsp. *ambigua* (Massal.) Schust.: CHESHIRE (Linden, 1937, YU); COÖS (Schuster 23112, F)

C. catenulata (Huben.) Lindb.: COÖS (Evans, 1917, YU); GRAFTON (Evans et al., 1908, YU)

C. connivens (Dicks.) Lindb.: BELKNAP (Clayton 497); CARROLL (1342); GRAFTON (Hutchinson 298)

C. loitlesbergii Schiffn.: GRAFTON (Evans et al., 1908, YU)

C. lunulifolia (Dum.) Dum.: CARROLL (Rel. Farlow 500); CHESHIRE (Lorenz, 1915, YU); COÖS (Cleavit 1265); GRAFTON (698b)

C. macounii (Aust.) Aust.: COÖS (Farlow, no date, YU)

C. macrostachya Kaal.: GRAFTON (Lorenz, 1917, YU)

C. pleniceps (Aust.) Lindb.: BELKNAP (Carter 240, YU); COÖS (Engstrom, 1996; Evans, 1917, YU); GRAFTON (Lorenz, 1908,YU); White Mts. (Oakes type!)

Cladopodiella fluitans (Nees.) Joerg.: CARROLL (Evans 1905); COÖS (Schuster 68-2137); GRAFTON (Evans et al. 1908; 1487); MERRIMACK (Quillinan 94-10138)

C. francisci (Hook.) Buch.: COÖS (Lorenz, 1916, YU); GRAFTON (Lorenz 132, YU)

Nowellia curvifolia (Dicks.) Mitt. : CARROLL (Farlow, 1904, YU); CHESHIRE (Nichols, 1932, YU); COÖS (Schuster 1944); GRAFTON (832); HILLSBOROUGH (796); ROCKINGHAM (902)

Odontoschisma denudatum (Mart.) Dum.: CARROLL (Farlow, 1906, YU; 1172); CHESHIRE (Schuster 19453); COÖS (Rel. Farlow 522; Sperduto 4324); GRAFTON (Lorenz 467, YU)

O. elongatum (Lindb.) Evans: GRAFTON (Evans, 1911, YU)

Cephaloziellaceae

Cephaloziella byssacea (Roth.) Warnst.: GRAFTON (Lorenz, 1911, YU); MERRIMACK (Quillinan 94-101-41)

C. divaricata (Sm.) Warnst. : GRAFTON (Evans et al., 1908, NY)

C. elachista (Jack.) Schiffn.: GRAFTON (Lorenz, 1926, YU)

C. elachista fo. *angustiloba* (Douin) Schust.: CHESHIRE (Schuster 19456); GRAFTON (Lorenz 787, TYPE!, YU)

C. hampeana (Nees.) Schiffn. ex Loeske.: CARROLL (Farlow, 1904, NYS); COÖS (Evans, 1917, YU); MERRIMACK (Andrews 1915)

C. rubella (Nees.) Warnst.: COÖS (Andrews, 1917; 1261); GRAFTON (Lorenz 390, YU)

C. rubella var. *bifida* (Lindb.) Douin.: CARROLL (Rel. Farlow. 501b)

C. rubella var. *elegans* (Heeg.) Schust.: GRAFTON (Lorenz 790, YU)

C. rubella var. *sullivantii* (Aust.) K. Müll.: CARROLL (Farlow, 1904, YU); GRAFTON (Lorenz, 1911, YU)

C. spinigera (Lindb.) Joerg.: CHESHIRE (Schuster 19456); COÖS (Schuster 68-2138)

Codoniaceae

Fossombronia cristula Aust.: STRAFFORD (Storks, 1976, NYS)

F. foveolata Lindb.: CARROLL (Farlow, 1906, YU); COÖS (Farlow, 1891, NY); GRAFTON (Lorenz 814, YU); HILLSBOROUGH (799)

F. wondraczekii (Corda.) Dum.: COÖS (Haynes, 1893, NY)

Conocephalaceae

Conocephalum conicum (L.) Lindb.: COÖS (1013); GRAFTON (1042); STRAFFORD (Hodgdon 18977, NHA)

Frullaniaceae

Frullania brittoniae Evans: SULLIVAN (Haynes, 1904, YU)

F. eboracensis Gottsche: BELKNAP (1577); CARROLL (Evans, 1889, YU; 1499); COÖS (Evans, 1917, YU; 1269); GRAFTON (Evans et al., 1908, NY); ROCKINGHAM (1597); SULLIVAN (Haynes, 1904, YU)

F. oakesiana Aust.: CHESHIRE (Miller 5650, NYS); COÖS (Schuster, 1944); GRAFTON (Lorenz 388, NYS)

F. riparia Hampe ex. Lehm.: White Mts. (Austin, no date, NY)

F. selwyniana Pears.: COÖS (Andrews, 1917)

F. tamarisci (L.) Dum. subsp. *asagrayana* (Mont.) Hatt.: CARROLL (Evans, 1896, YU); CHESHIRE (872); COÖS (Evans, 1917, YU; 1255); GRAFTON (825)

Geocalycaceae

Chiloscyphus pallescens (Ehrh.) Dum.: CARROLL (Evans, 1890); COÖS (Evans, 1917, YU; Engstrom, 1996); GRAFTON (Lorenz, 1913, YU; 1216)

C. pallescens var. *fragilis* (Roth.) K. Müll.: COÖS (Rel. Farlow. 502); GRAFTON (Evans 1912)

C. polyanthus (L.) Corda.: BELKNAP (Carter, 1893); COÖS (Wheeler, 1900); GRAFTON (Lorenz, 1908, YU; 1396)

Geocalyx graveolens (Schrad.) Nees.: COÖS (Schuster 74-2850f, F); MERRIMACK (Andrews, 1915)

Harpanthus drummondii (Tayl.) Grolle.: COÖS (Schuster 74-2850a, F); GRAFTON (Evans et al., 1908 as *H. scutatus*, YU)

H. flovotianus (Nees.) Nees.: COÖS (Andrews, 1917)

H. scutatus (Web. & Mohr.) Spr.: CARROLL (Rel. Farlow. 506); COÖS (Evans, 1917, YU; Sperduto 6715); GRAFTON (Evans, 1911, YU)

Lophocolea cuspidata (Nees.) Limpr.: COÖS (Lorenz, 1916, YU)

L. heterophylla (Schrad) Dum.: COÖS (Evans, 1917, YU); GRAFTON (566); HILLSBOROUGH (795); ROCKINGHAM (902); SULLIVAN (Haynes 704, YU)

L. minor Nees.: SULLIVAN (Haynes, 1904, YU)

Gymnomitriaceae

Gymnomitrion concinnatum (Lightf.) Corda.: COÖS (Miller 7015, NYS); GRAFTON (Evans et al., 1908)

G. corallioides Nees.: COÖS (Miller 7012, NYS)

Marsupella emarginata (Ehrh.) Dum.: CARROLL (1353); CHESHIRE (890); COÖS (Rel. Farlow. 515; 1247); GRAFTON (699); MERRIMACK (Quillinan 94-101-34)

M. sparsifolia (Lindb.) Dum.: COÖS (Evans, 1905, YU)

M. sphacelata (Gies.) Dum.: CHESHIRE (Miller 7995, NYS); CARROLL (Farlow, 1907, YU); COÖS (Underwood & Cook, 1889, YU; Miller 992, NYS); GRAFTON (Farlow, 1905, YU)

M. ustulata (Huben.) Spr.: CHESHIRE (Rel. Farlow. 517); COÖS (Oakes, no date, NYS; Schuster, 1944, F)

Jubulaceae

Jubula pennsylvanica (Steph.) Evans: BELKNAP (1561); CARROLL (Rel. Farlow. 507); GRAFTON (1392)

Jungermanniaceae

Chandonanthus setiformis (Ehrh.) Lindb.: COÖS (1234); GRAFTON (Evans, 1908, YU; 1457)

Jamesoniella autumnalis (DC.) Steph.: CARROLL (Farlow, 1906, YU; 1345); CHESHIRE (950); COÖS (1258); GRAFTON (828); STRAFFORD (931); SULLIVAN (Haynes, 1904, YU)

Jungermannia lanceolata L. emend. Schrad.: COÖS (Rel. Farlow. 508); GRAFTON (Lorenz, 1908)

Mylia anomala (Hook.) S.F. Gray.: CARROLL (Rel. Farlow. 519); COÖS (Williams 1); HILLSBOROUGH (610)

M. taylori (Hook.) S.F. Gray.: CARROLL (Farlow, 1906, YU); COÖS (Evans, 1917, YU; 1240); GRAFTON (Lorenz, 1908, YU; 1281)

Solenostoma cordifolium (Hook.) Steph.: GRAFTON (Lorenz 222, YU)

S. gracillimum (Smith) Schust.: CARROLL (Evans, 1917, YU); COÖS (Evans, 1917, YU); GRAFTON (851)

S. hyalinum (Lyell. in Hook.) Mitt.: CHESHIRE (Greenwood, 1925, YU); COÖS (Evans, 1917, YU); GRAFTON (Lorenz, 1926, YU)

S. obovatum (Nees.) Schust.: COÖS (Evans, 1890, YU)

S. obscurum (Evans) Schust.: CARROLL (Underwood & Cook, Hep. Am. 83)

S. pumilum (With.) K. Müll.: CARROLL (Miller 2162, NYS); CHESHIRE (Greenwood, 1925, YU); GRAFTON (Lorenz, 1912, YU)

S. sphaerocarpum (Hook.) Steph.: COÖS (Andrews, 1918); GRAFTON (Lorenz 91, YU)

Lejeuneaceae

Cololejeunea biddlecomiae (Aust.) Evans: SULLIVAN (Haynes 714a, YU)

Lejeunea cavifolia (Ehrh.) Lindb. emend Buch.: COÖS (Sperduto 6749.1); GRAFTON (1403); MERRIMACK (Andrews, 1915)

Leucolejeunea clypeata (Schwein.) Evans: CHESHIRE (J.S. Russell, 1844, NY)

Lepidoziaceae

Bazzania denudata (Torrey) Trev.: COÖS (976); GRAFTON (1393)

B. tricrenata (Wahl.) Trev.: CARROLL (Allen, 1880, YU); COÖS (Evans, 1917, YU);

GRAFTON (1041)

B. trilobata (L.) Gray: COÖS (Sperduto 4873); GRAFTON (819); HILLSBOROUGH (806); ROCKINGHAM (Sperduto 4948); STRAFFORD (Littlefield 1961, NHA)

Lepidozia reptans (Dum.) Dum.: COÖS (979); GRAFTON (829); ROCKINGHAM (Greenwood, 1914, NY); STRAFFORD (934)

Microlepidozia setacea (Weber) Jörg.: GRAFTON (Lorenz, 1908, YU)

Lophoziaceae

Anastrophyllum hellerianum (Nees.) Schust.: COÖS (Schuster 74-2862, F); GRAFTON (Lorenz, 1908, YU)

A. michauxii (Web.) Buch.: COÖS (1266); GRAFTON (1217)

A. minutulum (Schreb. ex. Cranz.) Schust.: CARROLL (Miller 2155, NYS); COÖS (Miller 988, NYS); GRAFTON (Evans et al., 1908, YU; 1352); MERRIMACK (Quillinan 94-101-27-1)

Gymnocolea inflata (Huds.) Dum.: CARROLL (Andrews, 1915); COÖS (Williams 2); GRAFTON (1501); HILLSBOROUGH (1140)

Lophozia alpestris (Schleich.) Evans: COÖS (Miller 7018, NYS); GRAFTON (Lorenz 93, YU)

L. ascendens (Warnst.) Schust.: COÖS (Sperduto 6724); GRAFTON (Lorenz 440, YU); MERRIMACK (Quillinan 94-101-19)

L. atlantica (Kaal.) Schiffn.: COÖS (Miller 7091, NYS)

L. attenuata (Mart.) Dum.: CHESHIRE (Lorenz, 1915, YU); COÖS (Miller 1632, NYS); GRAFTON (Lorenz, 1909, YU; 1174); MERRIMACK (Quillinan 94-101-19)

L. badensis (G. ex. G. & Rabenh.) Schiffn.: COÖS (Evans, 1917, YU)

L. barbata (Schmid.) Dum.: COÖS (Schuster, 1944, F); GRAFTON (Evans et al., 1908)

L. bicrenata (Schmid.) Dum.: CARROLL (Farlow, 1911, YU); CHESHIRE (955); COÖS (Evans, 1902, YU); GRAFTON (Lorenz, 1926, YU)

L. capitata (Hook.) Boulay.: COÖS (Evans, 1917, YU); GRAFTON (Evans, 1917, YU, 747)

L. floerkei (Web. & Mohr.) Schiffn.: COÖS (Schuster 68-2080, F)

L. gillmani (Aust.) Schust.: COÖS (Andrews, 1917)

L. hatcheri (Evans) Steph.: COÖS (Miller 7001, NYS); GRAFTON (Lorenz, 1915, YU)

L. heterocolpa (Thed.) Howe.: COÖS (Evans, 1917, YU)

L. incisa (Shrad.) Dum.: CHESHIRE (Greenwood 274)

L. kunzeana (Huben.) Evans.: COÖS (Miller 1629, NYS)

L. longidens (Lindb.) Macoun.: CARROLL (Farlow, 1904, YU); COÖS (Evans, 1917, YU, Miller 7005, NYS); GRAFTON (Lorenz 396, YU)

L. lycopodioides (Wallr.) Cogh.: COÖS (Schuster 68-2099, F)

L. marchica (Nees.) Steph.: GRAFTON (Lorenz 112, NYS)

L. porphyroleuca (Nees.) Schiffn.: COÖS (Miller 1647, NYS); GRAFTON (Lorenz, 1908, NYS); MERRIMACK (Andrews, 1915)

L. ventricosa (Dicks.) Dum.: COÖS (Miller 1634, NYS; 1251); GRAFTON (1381)

L. wenzelii (Nees.) Steph.: COÖS (Schuster 68-2103, F, with *Lophozia floerkei*)

Tritomaria exsecta (Schmid.) Schiffn.: CARROLL (Rel. Farlow. 535b); COÖS (Rel. Farlow. 535a)

T. exsectiformis (Breidl.) Schiffn.: CARROLL (Rel. Farlow. 534)

T. quinquedentata (Huds.) Buch.: CARROLL (Underwood & Cook, Hep. Am. 185); COÖS (Andrews, 1917; Miller 7022, NYS)

Marchantiaceae

Marchantia polymorpha L.: CARROLL (Sargent, 1911, NHA); COÖS (1473); GRAFTON (Evans et al., 1908, NY; Sperduto 4275); HILLSBOROUGH (Walke 14, NHA); STRAFFORD (Hodgdon & Steele 7092, NHA); SULLIVAN (Haynes, 1906, NY; 1477)

Preissia quadrata (Scop.) Nees.: CARROLL (Smith & Miller 35694, NYS); COÖS (Evans, 1917, YU; 980); GRAFTON (Lorenz, 1914, YU; 1116); MERRIMACK (Walke, 1968, NHA); STRAFFORD (Hodgdon & Steele, 1961, NHA)

Metzergiaceae

Metzergia conjugata Lindb.: GRAFTON (Lorenz 445, YU)

M. furcata var. *ulvula* Nees.: CARROLL (Evans, 1898, YU; 1186); COÖS (1578); GRAFTON (1209); HILLSBOROUGH (Huntington, 1910, YU); SULLIVAN (Haynes, 1904, YU)

M. pubescens (Schrank.) Raddi.: GRAFTON (Haynes, 1908, YU)

Pallaviciniaceae

Moerckia hibernica fo. *hibernica* (Hook.) Gottsche.: COÖS (Evans, 1917, YU; 1505)

M. hibernica fo. *flotowiana* (Nees.) de Sloover.: COÖS (Evans, 1917, YU); GRAFTON (Lorenz, no date, YU)

Pallavicinia lyellii (Hook.) Carruth.: CARROLL (Hodgdon, 1939, NHA); GRAFTON (Lorenz, 1915, YU); HILLSBOROUGH (781)

Pelliaceae

Pellia epiphylla (L.) Corda.: COÖS (1137); GRAFTON (707); HILSBOROUGH (756); MERRIMACK (1010); STRAFFORD (Hodgdon & Burleigh, 12648, NHA); SULLIVAN (Haynes, 1904, YU)

P. megaspora Schust.: COÖS (Andrews, 1917; 1446); GRAFTON (1337); SULLIVAN (1338)

P. neesiana (Gottsche.) Limpr.: COÖS (Evans, 1917, YU; 1543); GRAFTON (Evans, 1913, YU; 1055); HILLSBOROUGH (756)

Plagiochilaceae

Plagiochila asplenioides (L.) Dum.: CARROLL (Farlow, 1906, YU); CHESHIRE (Eaton, 1855, YU); COÖS (Andrews, 1917; 1483); GRAFTON (833);

HILLSBOROUGH (787); STRAFFORD (Randle, 1960, NHA); SULLIVAN (Haynes 701, YU)

P. austinii Evans: COÖS (T. P. James, 1857, NY)

Porellaceae

Porella pinnata L.: CHESHIRE (Eaton, 1856, YU); HILLSBOROUGH (771); MERRIMACK (Walke, 1968, NHA)

P. platyphylla (L.) Pfeiff.: CHESHIRE (1592); STRAFFORD (882); SULLIVAN (Haynes, 1904, YU)

P. platyphylloidea (L.) Pfeiff.: CHESHIRE (954); GRAFTON (836); HILLSBOROUGH (856)

Pseudolepicoleaceae

Blepharostoma trichophyllum (L.) Dum.: CARROLL (Evans, 1890, YU); COÖS (Rel. Farlow. 495b; Miller 1456, NYS); GRAFTON (571); SULLIVAN (Haynes 729a, YU)

Ptilidiaceae

Ptilidium ciliare (L.) Hampe: CARROLL (Hodgdon & Straughan 7129, NHA); CHESHIRE (Schuster 23101, F); COÖS (Rel. Farlow. 525a); GRAFTON (839); HILLSBOROUGH (Walke, 1968, NHA); MERRIMACK (Andrews, 1915); STRAFFORD (Randle, 1961, NHA; 918)

P. pulcherrimum (L.) Hampe: CARROLL (H.H. Bartlett, 1906); GRAFTON (840); MERRIMACK (Quillinan 94-101-30); ROCKINGHAM (905); STRAFFORD (904)

Radulaceae

Radula complanata (L.) Dum.: BELKNAP (1573); COÖS (Sperduto 6749.3); GRAFTON (843); HILLSBOROUGH (760); MERRIMACK (1590); ROCKINGHAM (Sperduto 4943a)

R. tenax Lindb.: COÖS (Underwood & Cook, Hep. Am. 52)

Ricciaceae

Riccia fluitans L.: CARROLL (Hellquist 6553, NHA); STRAFFORD (Hodgdon & Pike 16795, NHA)

Ricciocarpus natans (L.) Corda.: GRAFTON (Sargent, 1890, NHA); STRAFFORD (Hodgdon & Mock 11021, NHA)

Scapaniaceae

Diplophyllum apiculatum (Evans) Steph.: COÖS (Farlow, 1900, NHA, Sperduto 6754); GRAFTON (821); HILLSBOROUGH (793); STRAFFORD (1593)

D. taxifolium (Wahl.) Dum.: COÖS (Miller 7011, NYS); GRAFTON (Evans, 1913, YU; 1341)

Scapania apiculata Spr.: COÖS (Andrews, 1917)

S. curta (Mart.) Dum.: CARROLL (Evans, 1902, YU); COÖS (Farlow, 1897, YU)

S. glaucocephala (Tayl.) Aust.: GRAFTON (Lorenz, 1914, YU)

S. irrigua (Nees.) Dum.: CARROLL (Evans, 1902, YU); COÖS (Evans, 1917, YU); GRAFTON (Lorenz, 1914, YU)

S. mucronata Buch.: CARROLL (Evans, 1890, YU); GRAFTON (1402)

S. nemorea (L.) Grolle: BELKANAP (1570); CHESHIRE (860); COÖS (1263); GRAFTON (849); MERRIMACK (Quillinan 94-101-36); STRAFFORD (Hodgdon & Harrington, 1962, NHA; 1130)

S. paludicola Loeske & K. Müll.: GRAFTON (Evans et al., 1908, YU)

S. paludosa (K. Müll.) K. Müll.: COÖS (Miller 7027, NYS)

S. subalpina (Nees.) Dum.: COÖS (Andrews, 1917; Miller 7004, NYS)

S. umbrosa (Schrad.) Dum.: COÖS (Evans, 1917, YU; 1273); GRAFTON (Lorenz, 1909, YU)

S. undulata (L.) Dum.: CARROLL (Rel. Farlow. 533a); COÖS (1253); GRAFTON (846)

Tricholeaceae

Tricholea tomentella (Ehrh.) Dum.: CARROLL (Evans, 1917, YU); COÖS (Evans, 1917, YU; Engstrom, 1996); GRAFTON (Lorenz 44, YU; Engstrom, 1996); STRAFFORD (918)

BRYOPHYTA

Amblystegiaceae

Amblystegium serpens (Hedw.) Schimp.: CARROLL (1203); COÖS (Allen 24592, MO); GRAFTON (383)

A. varium (Hedw.) Lindb.: GRAFTON (698); MERRIMACK (Andrews, 1915)

Calliergon cordifolium (Hedw.) Kindb.: BELKNAP (Clayton, no date); CARROLL (1453);COÖS (Fabius 12199; Engstrom, 1996); GRAFTON (1142); HILLSBOROUGH (757); MERRIMACK (Allen 10042, MO); STRAFFORD (Allen 25729, MO); SULLIVAN (1002)

C. giganteum (Schimp.) Kindb.: COÖS (1007); GRAFTON (1433)

C. stramineum (Dicks. ex Brid.) Kindb.: CARROLL (1165); COÖS (Miller 7016, NYS); GRAFTON (Lorenz, 1917, NY); MERRIMACK (Allen 13017, MO)

Calliergonella cuspidata (Hedw.) Loeske.: COÖS (1150); GRAFTON (Faxon, 1886, NY; 1127)

Campylium chrysophyllum (Brid.) J. Lange: CHESHIRE (944); COÖS (1122); GRAFTON (1127); ROCKINGHAM (594)

C. hispidulum (Brid.) Mitt.: CARROLL (Rel. Farlow. 589); COÖS (Andrews, 1904); GRAFTON (576)

C. polygamum (Schimp.) C. Jens.: CHESHIRE (952); GRAFTON (Hutchinson, 1947, NY); HILLSBOROUGH (777)

C. radicale (P. Beauv.) Grout.: COÖS (1469); GRAFTON (Hutchinson, 1948, NY)

C. stellatum (Hedw.) C. Jens.: COÖS (1014); GRAFTON (1434)

Cratoneuron filicinum (Hedw.) Spruce: COÖS (Sperduto 6467); SULLIVAN (1000)

Drepanocladus aduncus (Hedw.) Warnst.: COÖS (Rel. Farlow. 574); GRAFTON (James, 1857, MO)

D. sendtneri (Schimp.) Warnst.: COÖS (Faxon, 1882, NY)

Hygroamblystegium fluviatile (Hedw.) Loeske: BELKNAP (Stevens, 1903; 1571); COÖS (1139); HILLSBOROUGH (774); MERRIMACK (Allen 16788, MO); SULLIVAN (1119)

H. tenax (Hedw.) Jenn.: COÖS (Rel. Farlow. 574); GRAFTON (Small 810); MERRIMACK (Allen 10047, MO)

Hygrohypnum duriusculum (DeNot) Jamieson: BELKNAP (Evans, 1890, NY); COÖS (OD Allen, 1880, NY); GRAFTON (Lorenz 74, NY)

H. eugyrium (B.S.G.) Loeske: BELKNAP (Carter, 1904); CHESHIRE (Rel. Farlow. 586); COÖS (Andrews, 1917); GRAFTON (440); HILLSBOROUGH (783); MERRIMACK (Allen 10033, MO)

H. luridum (Hedw.) Jenn.: GRAFTON (1394)

H. molle (Hedw.) Loeske: BELKNAP (Stevens, MO); COÖS (Andrews, 1917); GRAFTON (1215a)

H. montanum (Lindb.) Broth.: COÖS (Andrews, 1917); GRAFTON (442)

H. ochraceum (Turn ex Wils.)Loeske: BELKNAP (Carter, 1904); CHESIRE (941); COÖS (1223); GRAFTON (444)

Leptodictyum humile (P. Beauv.) Ochyra.: COÖS (1121)

L. riparium (Hedw.) Warnst.: CARROLL (1134); CHESIRE (Ladd 7337, MO); COÖS (1249); GRAFTON (1355); HILLSBOROUGH (789)

Limprichtia revolvens (Sw.) Loeske: COÖS (Miller 8692, NYS)

Platylomella lescurii (Sull. in Gray) Andrews: CARROLL (Rel. Farlow. 576); MERRIMACK (Allen 10039, MO); STRAFFORD (Allen 25724, MO)

Sanionia uncinata ((Hedw.) Loeske: CARROLL (1154); COÖS (Rel. Farlow. 594; 1237); GRAFTON (1500); HILLSBOROUGH (604); MERRIMACK (Andrews, 1915); SULLIVAN (Butler, MO)

Warnstorfia exannulata (Schimp. in BSG) Loeske: BELKNAP (Carter, 1905); CHESHIRE (Miller 7990, NYS); COÖS (Wickes, MO); GRAFTON (433)

W. fluitans (Hedw.) Loeske: CARROLL (1168); CHESHIRE (Miller 5649, NYS); COÖS (1350); GRAFTON (Sperduto 4648); MERRIMACK (Allen 10053, MO); STRAFFORD (915); SULLIVAN (Butler, MO)

W. sarmentosum (Wahlenb.) Hedenäs.: COÖS (Faxon, 1886, NY)

Andreaeaceae

Andreaea crassinervia Bruch.: CARROLL (Lowe, MAINE)

A. rothii Web. & Mohr: GRAFTON (384); HILLSBOROUGH (798)

A. rupestris Hedw.: BELKNAP (Stevens, MAINE); CARROLL (1195); COÖS (Allen 171, MO); GRAFTON (385); MERRIMACK (Quillinan 94-101-34-2)

Anomodontaceae

Anomodon attenuatus (Hedw.) Hueb.: CHESHIRE (893); COÖS (Sperduto 6529a); GRAFTON (387); HILLSBOROUGH (767); MERRIMACK (Allen 12977, MO); ROCKINGHAM (Sperduto 4940)

A. minor (Hedw.) Furnr.: "Sears" (Moulton, 1887, NY)

A. rostratus (Hedw.) Schimp.: CARROLL (Rel. Farlow. 577); CHESHIRE (861); COÖS (Sperduto 6529b); GRAFTON (1437); ROCKINGHAM (Sperduto 4937)

A. rugellii (C. Müll.) Keissl.: COÖS (Andrews, 1917); GRAFTON (388)

A. viticulosus (Hedw.) Hook.: HILLSBOROUGH (Huntington, 1904, NY)

Haplohymenium triste (Ces. ex DeNot) Kindb.: CARROLL (Rel. Farlow. 595); GRAFTON (718)

Aulocomniaceae

Aulocomnium androgynum (Lindb. & Arnell) Kindb.: COÖS (Forman B409, NY)

A. heterostichum (Hedw.) Bruch. & Schimp.: CHESHIRE (863); COÖS (Shaffer, 1873, NY)

A. palustre (Hedw.) Schwaegr.: CHESHIRE (Ladd 17332, MO); COÖS (Andrews, 1917; Engstrom, 1996); GRAFTON (394); HILLSBOROUGH (788); MERRIMACK (1144); ROCKINGHAM (897); STRAFFORD (916)

A. turgidum (Wahlenb.) Schwaegr.: COÖS (Miller 1988, NYS)

Bartramiaceae

Bartramia pomiformis Hedw.: BELKNAP (Clayton, 1930); COÖS (Croasdale, 1940, NYS); GRAFTON (396); STRAFFORD (926); SULLIVAN (1339)

Conostomum tetragonum (Hedw.) Lindb.: COÖS (AT Beals, 1918, DUKE)

Philonotis fontana (Hedw.) Brid. var. *fontana*: COÖS (Wheeler, 1905); GRAFTON (720); ROCKINGHAM (Huntington, Aug 3rd, no year); SULLIVAN (1001)

P. fontana var. *americana* (Dism.) Flow.: GRAFTON (1447)

P. fontana var. *caespitosa* (Jur.) Schimp.: GRAFTON (1290)

P. fontana var. *pumila* (Turn.) Brid.: CHESHIRE (859); GRAFTON (Sperduto 4889)

P. marchica (Hedw.) Brid.: COÖS (1584); SULLIVAN (1123)

P. yezoana Besch. & Card.: GRAFTON (1291)

Plagiopus oederianus (Sw.) Crum & Anderson: COÖS (1547); GRAFTON (Merrill 264, FH; 1115)

Brachytheciaceae

Brachythecium acuminatum (Hedw.) Aust.: GRAFTON (1210); MERRIMACK (Allen 10050, MO); SULLIVAN (Sherrard, 1974, NYS)

B. campestre (C. Müll.) Schimp.: GRAFTON (Grout, N. Amer. Musci Pleur. 7)

B. digastrum (C. Müll.) Kindb.: GRAFTON (Sperduto 4277)

B. erythrorrhizon Schimp.: White Mts. (Austin, 1892, NY)

B. laetum (Brid.) B.S.G.: CARROLL (1206); CHESHIRE (1146); COÖS (Shaffer, 1873, NY)

B. oedipodium (Mitt.) Jaegr.: COÖS (Wheeler, 1903); GRAFTON (Grout, 1897)

B. plumosum (Hedw.) Schimp.: BELKNAP (Clayton 291); CARROLL (1205); COÖS (Rel. Farlow. 578; 1587); GRAFTON (397); MERRIMACK (Allen 10043, MO); ROCKINGHAM (899); STRAFFORD (Allen 25732, MO)

B. populeum (Hedw.) Schimp.: CARROLL (Cummings, MO); COÖS (Wheeler, 1905); GRAFTON (Andrews, 1904)

B. reflexum (Stark.) Schimp.: CARROLL (James, MO); COÖS (1235b); GRAFTON (590)

B. rivulare Schimp.: BELKNAP (Carter, 1893); COÖS (Wheeler, 1903; 1242); HILLSBOROUGH (Huntington, 1903, NY); MERRIMACK (Allen 10036, MO)

B. rutabulum (Hedw.) Schimp.: COÖS (1243); GRAFTON (Adams, 1902); HILLSBOROUGH (778)

B. salebrosum (Web. & Mohr) Schimp.: BELKNAP (Clayton 441); CHESHIRE (942); COÖS (1238); GRAFTON (721); MERRIMACK (Allen 21147a, MO); ROCKINGHAM (Sperduto 4939)

B. velutinum (Hedw.) Schimp.: HILLSBOROUGH (794); GRAFTON (704); STRAFFORD (887)

Bryhnia graminicolor (Brid.) Grout: CARROLL (1185)

B. novae-angliae (Sull & Lesq) Grout: BELKNAP (Stevens 1024 ; 1569); CHESHIRE (891); COÖS (Wheeler, 1905); GRAFTON (407); HILLSBOROUGH (779); MERRIMACK (Allen 16789, MO)

Cirriphyllum piliferum (Hedw.) Grout: COÖS (Engstrom, 1996)

Eurhynchium hians (Hedw.) Sande Lac.: COÖS (1268)

E. praelongum (Hedw.) Schimp.: COÖS (1218)

E. pulchellum (Hedw.) Jenn.: COÖS (Andrews, 1918; Engstrom, 1996); GRAFTON (1173)

Platyhypnidium riparoides (Hedw.) Dix.: BELKNAP (Carter, 1904); COÖS (1138); MERRIMACK (Allen 10032, MO)

Steerecleus serrulatus (Hedw.) Robins.: HILLSBOROUGH (776)

Tomentypnum nitens (Hedw.) Loeske.: COÖS (Engstrom, 1996); GRAFTON (1117)

Bruchiaceae

Trematodon ambiguus (Hedw.) Hornsch.: CARROLL (Rel. Farlow. 571); COÖS (Cummings 1278, MO); GRAFTON (997)

T. longicollis Michx.: White Mts. (James, 1857, NY)

Bryaceae

Bryum algovicum Sendtn. ex Müll. Hal.: COÖS (Andrews, 1917); GRAFTON (Mathias

179, MO)

B. alpinum Huds. ex. With.: White Mts. (Oakes 195)

B. amblyodon Müll. Hal.: CARROLL (JA Allen, no date)

B. argenteum Hedw.: CHESHIRE (Ladd 17335, MO); HILLSBOROUGH (577); ROCKINGHAM (1589)

B. caespiticium Hedw.: COÖS (Faxon 251); GRAFTON (Faxon 1886, NY)

B. capillare Hedw.: CARROLL (1187); GRAFTON (1141); HILLSBOROUGH (763); MERRIMACK (Andrews, 1915); STRAFFORD (1131)

B. lisae DeNot var. *cuspidatum* (Bruch. & Schimp.) Marg.: COÖS (Andrews, 1917); GRAFTON (1371); HILLSBOROUGH (589b)

B. muehlenbeckii Bruch & Schimp.: White Mts. (Andrews, 1872)

B. pallens (Brid.) Sw.: COÖS (Faxon 256)

B. pseudotriquetrum (Hedw.) Gaertn. et al.: COÖS (Wheeler, 1903); GRAFTON (996); HILLSBOROUGH (785); MERRIMACK (1009); SULLIVAN (1005)

B. uliginosum (Brid.) Bruch. & Schimp.: SULLIVAN (1109)

B. weigelii Spreng.: COÖS (Farlow, 1894, NY; 1533)

Leptobryum pyriforme (Hedw.) Wils.: CARROLL (Lowe, MAINE); COÖS (1153); GRAFTON (Cummings, 1884, NY); HILLSBOROUGH (Britton, 1889, NY)

Pohlia andalusica (Hohn.) Broth.: CARROLL (Miller 2158, NYS); COÖS (Smith & Miller 35683, NYS)

P. annotina (Hedw.) Lindb.: CHESHIRE (868); COÖS (1274); GRAFTON (989); HILLSBOROUGH (1297); MERRIMACK (Allen 13011, MO); ROCKINGHAM (896)

P. bulbifera (Warnst.) Warnst.: COÖS (Miller 7002, NYS); GRAFTON (486); HILLSBOROUGH (991)

P. cruda (Hedw.) Lindb.: COÖS (Underwood & Cook, 1889, NY; 1550); GRAFTON (Chandler, 1884, NY; 1285); SULLIVAN (988); MERRIMACK (Allen 23074, MO)

P. drummondii (Müll. Hal.) Andrews: COÖS (Forman, 1960, NY)

P. elongata Hedw.: COÖS (Miller 2153, NYS); GRAFTON (Wheeler, 1903)

P. filum (Schimp.) Mårt.: CARROLL (Miller 2158, NYS)

P. lescuriana (Sull.) Grout.: GRAFTON (990)

P. longicolla (Hedw.) Lindb.: COÖS (Andrews, 1926)

P. nutans (Hedw.) Lindb.: CHESHIRE (869); COÖS (1503); GRAFTON (488); HILLSBOROUGH (595); MERRIMACK (Quillinan 94-101-29-2); STRAFFORD (930)

P. proligera (Kindb.) Broth.: CARROLL (Smith & Miller 35696, NYS); HILLSBOROUGH (Huntington, 1903, NY)

P. wahlenbergii (Web. & Mohr.) Andrews: COÖS (Lowe, 1926)

Rhodobryum ontariense (Kinb.) Par.: CHESHIRE (Ladd 7342, MO); COÖS (Croasdale, 1942, NYS); GRAFTON (Welch, 21636, NY)

Buxbaumiaceae

Buxbaumia aphylla Hedw.: CHESHIRE (Harris, Hodgdon & Smith 1808, NEBC/FH); GRAFTON (Cummings, MO); HILLSBOROUGH (Harris & Crane 3667, NEBC/FH); MERRIMACK (Allen 10044, MO); ROCKINGHAM (906); STRAFFORD (Harris 854, NEBC/FH)

B. minakatae Okam.: CHESHIRE (Britton, 1902, NEBC/FH)

Diphyscium foliosum (Hedw.) Mohr.: CHESHIRE (Miller 5643, NYS); COÖS (1547); GRAFTON (429); MERRIMACK (Allen 21797, MO); STRAFFORD (924); SULLIVAN (Butler, MO)

Climaciaceae

Climacium americanum Brid.: CHESHIRE (960); GRAFTON (Balch, 1894, NY; 724); HILLSBOROUGH (768); MERRIMACK (1376)

C. dendroides (Hedw.) Web. & Mohr.: CHESHIRE (Seymour 2511, MO); COÖS (1440); GRAFTON (724); MERRIMACK (G. Allen 23, MO); SULLIVAN (Butler, MO)

Dicranaceae

Arctoa fulvella (Dicks.) Bruch. & Schimp.: COÖS (Miller 7024, NYS)

Cynodontium alpestre (Wahl.) Milde.: COÖS (Smith & Miller 34082, NYS); GRAFTON (1288)

C. schisti (Web. & Mohr.) Lindb.: COÖS (Sperduto, 4335, NYS)

C. strumiferum (Hedw.) Lindb.: COÖS (Wheeler, 1903)

C. tenellum (Bruch. & Schimp. in B.S.G.) Limpr.: COÖS (Grout, N. Amer. Musci. Perf. 377, MO)

Dichodontium pellucidum (Hedw.) Schimp.: COÖS (Sperduto 6701.2) ; SULLIVAN (Sperduto 4668)

Dicranella cerviculata (Hedw.) Schimp.: CARROLL (JA Allen, 1880, NY); COÖS (James, 1862, MO); GRAFTON (GP Anderson, 1935, DUKE)

D. heteromalla (Hedw.) Schimp.: CHESHIRE (865); COÖS (Allen 1435, MO; 1267); GRAFTON (417); MERRIMACK (Allen 21807, MO); ROCKINGHAM (910); STRAFFORD (875); SULLIVAN (Butler, MO)

D. palustris (Dicks.) Crundw.: GRAFTON (Faxon, 1893, NY)

D. rufescens (With.) Schimp.: COÖS (Forman B109, NY; 1260); GRAFTON (703)

D. schreberiana (Hedw.) Crum & Anderson var. *schreberiana*: SULLIVAN (Sperduto 4670)

D. schreberiana var. *robusta* (Schimp.) Crum & Anderson: COÖS (1334); SULLIVAN (999)

D. subulata (Hedw.) Schimp.: CARROLL (Holzinger, Musci Acrocarpi Bor.-Amer. 305, MO); COÖS (James, MO)

Dicranodontium denudatum (Brid.) Britton: GRAFTON (Wheeler, 1903)

Dicranoweisia crispula (Hedw.) Milde: COÖS (Andrews 1917)

Dicranum acutifolium (Lindb. & Arnell) Weinm.: COÖS (James, 1852, MO)

D. elongatum Schwaegr.: COÖS (Andrews, 1917); GRAFTON (1176)

D. fuscescens Turn.: CARROLL (1164); COÖS (1233); GRAFTON (Lambert, 1974, NYS)

D. ontariense Peters.: CARROLL (Miller 2156, NYS); COÖS (Rel. Farlow. 557); GRAFTON (Croasdale, 1950, DUKE); ROCKINGHAM (Mais, 1906, DUKE)

D. polysetum Sw.: CARROLL (Bartlett 589, MO); CHESHIRE (888); COÖS (Rel. Farlow. 559; 1494); GRAFTON (423); MERRIMACK (Allen 13009, MO)

D. scoparium Hedw.: CARROLL (1188); CHESIRE (Clark, 1920, NYS); COÖS (Wheeler, 1905); GRAFTON (424); HILLSBOROUGH (Smith, MO); MERRIMACK (Quillinan 94-101-30); ROCKINGHAM (903); STRAFFORD (885)

D. spurium Hedw.: COÖS (Fabius, 1959); HILLSBOROUGH (Huntington, 1904)

D. undulatum Brid.: COÖS (Wheeler, 1903); MERRIMACK (Andrews, 1915)

Orthodicranum flagellare (Hedw.) Loeske: BELKNAP (1574a); CARROLL (Grover, MO); CHESHIRE (Ladd 73331, MO); COÖS (Wheeler, 1903); GRAFTON (420); HILLSBOROUGH (792); MERRIMACK (Allen 12988, MO)

O. fulvum (Hook) Roth.: GRAFTON (750); HILLSBOROUGH (Britton, 1889); MERRIMACK (Allen 10049, MO); STRAFFORD (1129)

O. montanum (Hedw.) Loeske: CHESHIRE (Ladd 73330, MO); COÖS (Wheeler, 1903); GRAFTON (421); MERRIMACK (Allen 10048, MO); ROCKINGHAM (Roy, 1995); STRAFFORD (935)

O. viride (Sull. & Lesq.) Roth.: COÖS (Engstrom, 1995); GRAFTON (426); MERRIMACK (Allen 12994, MO); STRAFFORD (886)

Kiaeria blytii (Bruch. & Schimp.) Broth.: COÖS (Andrews, 1917); GRAFTON (Lambert, 1974, NHA)

K. starkei (Web. & Mohr.) Hag.: COÖS (Grout, N. Amer. Musci Perf. 352, MO)

Oncophorus wahlenbergii Brid.: COÖS (1256); GRAFTON (469); MERRIMACK (Andrews, 1915)

Paraleucobryum longifolium (Hedw.) Loeske: CARROLL (Rel. Farlow. 571); COÖS (Allen 168, MO); GRAFTON (470); MERRIMACK (Quillinan 94-101-17)

Ditrichaceae

Ceratodon purpureus (Hedw.) Brid.: CARROLL (Lowe, MAINE); CHESHIRE (Ladd 17334, MO); COÖS (Smith & Miller 34116, NYS); HILLSBOROUGH (589); MERRIMACK (Allen 13002, MO); ROCKINGHAM (900)

Distichium capillaceum (Hedw.) Bruch. & Schimp.: COÖS (Underwood & Cook, 1889, NY; 1008)

Ditrichum tortuloides Grout: COÖS (JA Allen, 1878, NY); GRAFTON (1390)

D. lineare (Sw.) Lindb.: CHESHIRE (Ladd 17333, MO); COÖS (Andrews, 1918); GRAFTON (573); HILLSBOROUGH (1377); MERRIMACK (Allen 21798, MO)

D. pallidum (Hedw.) Hampe.: CHESHIRE (Miller 5640, NYS); GRAFTON (Hutchinson, MO)

D. pusillum (Hedw.) Hampe.: COÖS (1120); GRAFTON (572); HILLSBOROUGH (801); MERRIMACK (Andrews, 1917)

Saelania glaucescens (Hedw.) Broth.: BELKNAP (Carter, 1901); COÖS (Miller 8477, NYS; 1481); GRAFTON (1043); MERRIMACK (Andrews, 1915); ROCKINGHAM (Huntington, no date); SULLIVAN (987)

Trichodon cylindricus (Hedw.) Schimp.: COÖS (Whitehouse NH73/5); STRAFFORD (Whitehouse NH73/1)

Encalyptaceae

Encalypta ciliata Hedw.: COÖS (Sperduto 6701.2b); GRAFTON (1046)

E. procera Bruch.: COÖS (982)

Entodontaceae

Entodon brevisetus (Hook. & Wils.) Lindb.: CARROLL (1197)

E. cladorrhizans (Hedw.) Müll. Hal.: White Mts. (Shaffer, 1879, NY)

E. seductrix (Hedw.) Müll. Hal.: HILLSBOROUGH (786)

Ephemeraceae

Ephemerum crassinervium (Schwaegr.) Hampe.: COÖS (Farlow, 1893, FH)

Micromitrium megalosporum Aust.: COÖS (Farlow, 1893)

Fabroniaceae

Anacamptodon splachnoides (Froel. ex Brid.) Brid.: COÖS (Forman B307, NY; 1228); GRAFTON (Welch 20291, NY)

Fissidentaceae

Fissidens adianthoides Hedw.: COÖS (Faxon, 1873, NY; 1015); GRAFTON (1330)

F. bryoides Hedw.: BELKNAP (Clayton 822); GRAFTON (Hutchinson, 1947); MERRIMACK (Allen 10038, MO)

F. bushii (Card. & Ther.) Card. & Ther.: GRAFTON (Hutchinson, 1946, MO)

F. dubius P. Beauv.: BELKNAP (Carter 131); CARROLL (Lowe, MO); GRAFTON (437); ROCKINGHAM (Sperduto 4941)

F. osmundioides Hedw.: COÖS (Andrews, 1917; 981); GRAFTON (1037); MERRIMACK (1454); STRAFFORD (Allen 25721, MO)

F. subbasilaris Hedw.: COÖS (Shaffer, 1873, NY); ROCKINGHAM (Sperduto 4942)

Fontinalaceae

Dichelyma capillaceum (With.) Myr.: CHESHIRE (Allen & Stair, 1939, NY); COÖS (Farlow, 1897, NY); MERRIMACK (1126); STRAFFORD (Allen 25719, MO)

D. falcatum (Hedw.) Myr.: CARROLL (Grout, N. Amer. Musci Perf. 396); COÖS (Rel. Farlow. 579)

D. pallescens Schimp.: BELKNAP (Clayton, 1930)

Fontinalis antipyretica Hedw.: MERRIMACK (Allen 10040, MO)

F. antipyretica var *gigantea* (Sull.) Sull.: BELKNAP (Carter, 1904); CARROLL (James, MO); CHESHIRE (Sull. & Lesq. 224c); COÖS (1562); GRAFTON (Cummings, 1878); SULLIVAN (Butler, MO)

F. dalecarlica Schimp.: BELKNAP (Carter, 1890; 1560); CARROLL (James, MO); COÖS (von Schrenk, MO); GRAFTON (1386); HILLSBOROUGH (1475); MERRIMACK (Allen 10041, MO); STRAFFORD (Allen, 25725, MO); SULLIVAN (Butler, MO)

F. flaccida Ren. & Card.: GRAFTON (James, 1853, NY); ROCKINGHAM (Huntington, no date, NY)

F. macmillanii Card.: GRAFTON (Faxon, 1891, NY)

F. novae-angliae Sull.: BELKNAP (Carter, 1901); CARROLL (1170); CHESHIRE (Mann, 1863); COÖS (Clayton 900); GRAFTON (Hutchinson, MO); HILLSBOROUGH (791); MERRIMACK (Allen 10030, MO); STRAFFORD (Allen 24722, MO)

F. sullivantii Lindb.: CARROLL (Austin 6, NY)

Funariaceae

Funaria hygrometica Hedw.: CARROLL (Smith & Miller 35695, NYS); COÖS (1152); GRAFTON (992)

Physcomitrium immersum Sull.: COÖS (Miller 8174, NYS)

P. pyriforme (Hedw.) Hampe: COÖS (994); HILLSBOROUGH (588)

Grimmiaceae

Grimmia affinis Hoppe & Hornsch.: White Mts (Shaffer, 1887, NY)

G. donniana Sm.: COÖS (N. Amer. Musci Perf. 353, YU ; Allen 1434, MO)

G. hartmanii Schimp.: COÖS (James, 1862, MO)

G. incurva Schwaegr.: COÖS (Kennedy, 1897, FH)

G. muehlenbeckii Schimp.: CHESHIRE (Ladd 17328, MO); MERRIMACK (G. Allen 26, MO)

G. olneyi Sull.: BELKNAP (Trask 505, NY)

G. pilifera P. Beauv.: GRAFTON (Andrews, 1905); ROCKINGHAM (Moulton, 1886, NY)

G. tenerrimum Ren & Card: COÖS (J. A. Allen, 1898, as *G. donniana*, YU)

Hydrogrimmia mollis (Bruch. & Schimp.) Loeske: COÖS (Evans, 1890, NY)

Racomitrium aciculare (Hedw.) Brid.: BELKNAP (Carter, no date); CARROLL (Dixon 16, FH); CHESHIRE (946); COÖS (Rickett 125, MO); GRAFTON (506)

R. aduncoides Bednarek-Ochyra: GRAFTON (503, NY); MERRIMACK (Allen 21154, MO)

R. canescens (Hedw.) Brid.: CARROLL (Smith & Miller 35681, NYS); COÖS

(Andrews, 1918); GRAFTON (FS Beaty, 1911, DUKE)

R. fasciculare (Hedw.) Brid.: COÖS (Grout, N. Amer. Musci Perf. 106, MO; 1222); GRAFTON (Kaiser, 1910; 1283); MERRIMACK (Allen 21811, MO)

R. lanuginosum (Hedw.) Brid.: COÖS (Rel. Farlow. 568; 1227)

R. sudeticum (Funck) Bruch. & Schimp.: CARROLL (Rel. Farlow. 569); COÖS (Grout 189, MO); GRAFTON (510)

R. venustum Frisvoll: COÖS (Andrews, 1918; 1219); GRAFTON (507); MERRIMACK (Quillinan 94-101-33-2)

Schistidium agassizii Sull. & Lesq.: COÖS (1545); GRAFTON (Cummings, no date, MO, 1559); STRAFFORD (Allen 25726, MO)

S. apocarpum (Hedw.) Bruch. & Schimp.: COÖS (James, MO); HILLSBOROUGH (808)

S. lancifolium (Kindb.) Blom.: COÖS (Allen 24597, MO)

S. rivulare (Brid.) Podp.: CARROLL (1179); CHESHIRE (959); COÖS (Kennedy, 1897, FH); GRAFTON (1213); HILLSBOROUGH (808)

Hedwigiaceae

Hedwigia ciliata (Hedw.) P. Beauv.: BELKNAP (Clayton 379); CARROLL (Rel. Farlow. 581); CHESHIRE (Ladd 17326, MO); COÖS (Andrews, 1917); GRAFTON (719); HILLSBOROUGH (766); STRAFFORD (932)

Helodiaceae

Helodium blandowii (Web. & Mohr) Warnst.: COÖS (Andrews, 1917); GRAFTON (1118)

H. paludosum (Web. & Mohr) Warnst.: HILLSBOROUGH (Nichols 356)

Hylocomiaceae

Hylocomiastrum pyrenaicum (Spruce) Fleisch.: CARROLL (OD Allen, 1878, NY); GRAFTON (Hutchinson, 1950, NY)

H. umbratum (Hedw.) Broth.: COÖS (Rel. Farlow. 593; 1239); GRAFTON (445)

Hylocomium splendens (Hedw.) Schimp.: COÖS (von Schrenk, MO); GRAFTON (447)

Loeskeobryum brevirostre (Brid.) Fleisch.: COÖS (Spence, 1867)

Pleurozium schreberi (Brid.) Mitt.: BELKNAP (Orwell, 1934, NEBC/FH); CARROLL (Swan, 1888, NEBC/FH); CHESHIRE (Orwell 1933, NEBC/FH); COÖS (Sperduto 6463); GRAFTON (483); HILLSBOROUGH (855); MERRIMACK (Allen 13008, MO); STRAFFORD (920); SULLIVAN (Tucker, 1929, NEBC/FH)

Rhytidium rugosum (Hedw.) Kindb.: COÖS (JA Allen, 1878, NY)

Rhytidiadelphus squarrosus (Hedw.) Warnst.: GRAFTON (723)

R. triquetrus (Hedw.) Warnst.: COÖS (Wheeler, 1903; 984); GRAFTON (1375)

Hypnaceae

Callicladium haldanianum (Grev.) Crum.: CHESHIRE (Rel. Farlow. 588); COÖS (Wheeler, 1905); GRAFTON (408); MERRIMACK (Allen 10034, MO);

ROCKINGHAM (898); STRAFFORD (912)

Ctenidium molluscum (Hedw.) Mitt.: CHESHIRE (862)

Herzogiella striatella (Brid.) Iwats.: BELKNAP (Clayton, 1929); CARROLL (Kennedy, 1899, FH; 1199); CHESHIRE (864); COÖS (Allen 170, MO); GRAFTON (438); MERRIMACK (Andrews, 1915); STRAFFORD (933)

H. turfacea (Lindb.) Iwats.: GRAFTON (Hutchinson, 1947, NY; 1177)

Homomallium adnatum (Hedw.) Broth.: CHESHIRE (Ladd 17327, MO); GRAFTON (Andrews, 1905); MERRIMACK (Andrews, 1915)

Hypnum cupressiforme Hedw.: COÖS (Sperduto 6699.8); HILLSBOROUGH (775); STRAFFORD (879)

H. curvifolium Hedw.: COÖS (Wheeler, 1905)

H. fauriei Card.: COÖS (Wheeler, 1905); GRAFTON (449)

H. imponens Hedw.: BELKNAP (1574b); COÖS (Wicks, 1939, NY); GRAFTON (725); MERRIMACK (Allen 12984, MO); ROCKINGHAM (Sperduto 4944); SULLIVAN (Butler, MO)

H. lindbergii Mitt.: BELKNAP (Carter, 1898; 1568); CHESHIRE (Adams, 1902); COÖS (Andrews, 1917; 1136); GRAFTON (Grout, 1897); HILLSBOROUGH (759); MERRIMACK (1011); SULLIVAN (1004)

H. pallescens (Hedw.) P. Beauv.: COÖS (Rel. Farlow. 591); GRAFTON (451); STRAFFORD (877); SULLIVAN (Butler, MO)

H. pratense Koch ex Spruce.: COÖS (Engstrom, 1996); GRAFTON (1471); SULLIVAN (1003)

Isoptergiopsis muelleriana (Schimp.) Iwats.: CARROLL (1192); COÖS (1552); CHESHIRE (894); GRAFTON (455)

I. pulchella (Hedw.) Iwats.: COÖS (OD Allen, 1878, NY, 1553); GRAFTON (JP James, 1866, NY; 1373); HILLSBOROUGH (790)

Isopterygium tenerum (Sw.) Mitt.: GRAFTON (1208)

Platydictya confervoides (Brid.) Crum: HILLSBOROUGH (852)

P. subtilis (Brid.) Crum: CARROLL (1183); COÖS (Wheeler, 1905; 1221); GRAFTON (1207); HILLSBOROUGH (857)

Platygyrium repens (Brid.) Schimp.: CARROLL (1202); COÖS (Wheeler, 1905; 1235a); GRAFTON (479)

Pseudotaxiphyllum distichaceum (Mitt) Iwats.: CARROLL (1155); GRAFTON (458)

P. elegans (Brid.) Iwats.: GRAFTON (459); MERRIMACK (Quillinan 94-101-331); STRAFFORD (878)

Ptilium crista-castrensis (Hedw.) DeNot.: CARROLL (James, MO); CHESHIRE (895); COÖS (Andrews, no date); GRAFTON (497); HILLSBOROUGH (1497); STRAFFORD (921)

Pylaisiadelpha tenuirostris (Bruch. & Schimp.) Buck: GRAFTON (705)

Pylaisia intricata (Hedw.) Schimp.: BELKNAP (Carter, 1902); CARROLL (1166); CHESHIRE (883); COÖS (James, MO); GRAFTON (501); STRAFFORD (883)

P. polyantha (Hedw.) Schimp.: CARROLL (1162); CHESHIRE (873); COÖS (Andrews, 1917); GRAFTON (569)

P. selwynii Kindb.: CARROLL (1198); COÖS (James, MO); GRAFTON (477); HILLSBOROUGH (807); MERRIMACK (Allen 12993, MO); ROCKINGHAM (901); STRAFFORD (Allen 25717, MO); SULLIVAN (Butler, MO)

Leskeaceae

Leskea gracilescens Hedw.: GRAFTON (Kennedy, 1897, FH); HILLSBOROUGH (858); MERRIMACK (Allen 10051, MO); SULLIVAN (Collins, 1934, NEBC/FH)

L. polycarpa Hedw.: BELKNAP (Clayton, 1930); GRAFTON (462); HILLSBOROUGH (755); MERRIMACK (Andrews,1915)

Leskeella nervosa (Brid.) Loeske: CARROLL (James, MO); COÖS (Wheeler, 1905); GRAFTON (463); HILLSBOROUGH (810); MERRIMACK (Allen 21149, MO)

Pseudoleskea patens (Lindb.) Kindb.: COÖS (Faxon, no year, NY)

P. radicosa (Mitt.) Mac. & Kindb.: COÖS (Grout N. Amer. Musci Pleur. 399, MO)

Leucobryaceae

Leucobryum glaucum (Hedw.) Ångström: BELKNAP (Stevens, 1903); CHESHIRE (951); COÖS (1332); GRAFTON (726); MERRIMACK (Allen 13010, MO)

Leucodontaceae

Forsstroemia trichomitria (Hedw.) Lindb.: COÖS (Shaffer, 1873, NY)

Leucodon andrewsianus (Crum & Anderson) Reese & Anderson: CARROLL (1201); GRAFTON (727)

L. brachypus Brid.: CHESHIRE (889); GRAFTON (Cummings, 1884, NY); STRAFFORD (883)

Mniaceae

Cyrtomnium hymenophylloides (Hüb.) T. Kop.: COÖS (975); GRAFTON (1286)

Mnium ambiguum H. Müll.: COÖS (1496); GRAFTON (Hutchinson, 1951, NY)

M. hornum Hedw.: CHESHIRE (Lowe, MAINE); GRAFTON (465); HILLSBOROUGH (770); ROCKINGHAM (907)

M. marginatum (With.) Brid. ex P. Beauv.: GRAFTON (Glime 3043, MCTC)

M. spinulosum (Voit) Schwaegr.: COÖS (983); GRAFTON (1293); MERRIMACK (Andrews, 1915)

M. stellare Hedw.: COÖS (1035); GRAFTON (Grout 25, MO)

M. thomsonii Schimp.: COÖS (Sperduto 6548); GRAFTON (1380)

Plagiomnium ciliare (Müll. Hal.) T. Kop.: BELKNAP (1572); COÖS (Wheeler, 1903; 1572); GRAFTON (1056); HILLSBOROUGH (Lampton 615, MO); MERRIMACK (Allen 21147, MO); STRAFFORD (Allen 25730, MO)

P. cuspidatum (Hedw.) T. Kop.: CARROLL (Moore, MO); COÖS (Croasdale, 1946, NYS); GRAFTON (472)

P. drummondii (Bruch. & Schimp.) T. Kop.: COÖS (Mann, no date); GRAFTON (Cummings, MO)

P. ellipticum (Brid.) T. Kop.: CARROLL (1191); COÖS (Shaffer, 1873, NY); STRAFFORD (Randle, 1960, NHA)

P. medium (Bruch. & Schimp.) T. Kop.: COÖS (Engstrom, 1996)

P. rostratum (Shrad.) T. Kop.: COÖS (1495); GRAFTON (Grout, 1898, NYS)

Pseudobryum cinclidioides (Hüb.) T. Kop.: CARROLL (James, MO); CHESHIRE (Sull. & Lesq. 196b); COÖS (Erickson 227, DUKE); GRAFTON (Hutchinson, 1949, DUKE)

Rhizomnium applalachianum T. Kop.: COÖS (1246); GRAFTON (Hutchinson, 1958, MO; 1563); HILLSBOROUGH (853)

R. magnifolium (Horik) T. Kop.: GRAFTON (513)

R. punctatum (Hedw.) T. Kop.: CHESHIRE (947); COÖS (Engstrom, 1996); GRAFTON (514); HILLSBOROUGH (758); MERRIMACK (Allen 21816, MO)

Neckeraceae

Homalia trichomanoides (Hedw.) Schimp.: BELKNAP (Clayton, 1930); COÖS (Wheeler, 1903); GRAFTON (1038)

Neckera pennata Hedw. var *pennata*: BELKNAP (Clayton 465); CARROLL (James, MO); COÖS (1492); GRAFTON (468); SULLIVAN (Butler, MO)

Thamnobryum alleghaniense (Müll. Hal.) Nieuwl.: GRAFTON (Hutchinson, 1947, NY); ROCKINGHAM (Eaton 1901, NY)

Orthotrichaceae

Drummondia prorepens (Hedw.) Britt.: BELKNAP (Carter, 1902); CARROLL (1194); GRAFTON (1212); MERRIMACK (Andrews, 1915); ROCKINGHAM (Sperduto 4943b)

Orthotrichum alpestre Hornsch.: HILLSBOROUGH (Clapp, 1903)

O. elegans Schwaegr.: GRAFTON (559); HILLSBOROUGH (800); MERRIMACK (Allen 12991c, MO)

O. obtusifolium Brid.: COÖS (1225); GRAFTON (1178); HILLSBOROUGH (1295); MERRIMACK (Allen 10052, MO); STRAFFORD (Allen 25717b, MO)

O. ohioense Sull. & Lesq.: CARROLL (1158); GRAFTON (Cummings, MO)

O. sordidum Sull. & Lesq.: BELKNAP (Clayton, 1929); CARROLL (1193); COÖS (Andrews, 1915); MERRIMACK (Andrews, 1915); STRAFFORD (Allen 25717a, MO)

O. stellatum Brid.: BELKNAP (Sdee, no date, NYS); CARROLL (1193); COÖS (1224); GRAFTON (Cummings, 1884, NY); ROCKINGHAM (1594)

O. striatum Hedw.: ROCKINGHAM (1595)

Ulota coarctata (P. Beauv.) Hamm.: CARROLL (1163); CHESHIRE (Ladd 17329, MO); COÖS (Allen 24585, MO); GRAFTON (555); MERRIMACK (Andrews, 1915); SULLIVAN (Butler, MO)

U. crispa (Hedw.) Brid.: BELKNAP (1576); COÖS (Allen 167, MO); GRAFTON (Cummings, MO); HILLSBOROUGH (803); MERRIMACK (Allen 10031, MO); STRAFFORD (923)

U. hutchinsiae (Sm.) Hammar.: BELKNAP (Clayton 831); CARROLL (Cummings, MO); CHESHIRE (Lowe, MO); GRAFTON (Wynne, 1945, NY; 1044); MERRIMACK (1591); STRAFFORD (929)

Plagiotheciaceae

Plagiothecium cavifolium (Brid.) Iwats.: BELKNAP (1575); CARROLL (1181); CHESHIRE (892); COÖS (Andrews, 1915); GRAFTON (Hutchinson, 1958; 1054); STRAFFORD (925)

P. denticulatum (Hedw.) Schimp.: CHESHIRE (1148); COÖS (1252); GRAFTON (474); MERRIMACK (Allen 13005, MO); SULLIVAN (Butler, MO)

P. laetum Schimp.: GRAFTON (476); MERRIMACK (Quillinan 94-101-15); ROCKINGHAM (909)

Polytrichaceae

Atrichum angustatum (Brid.) Bruch & Schimp.: CARROLL (Grover, MO); GRAFTON (391); MERRIMACK (Allen 12979, MO)

A. crispum (James) Sull.: COÖS (1229): GRAFTON (390); MERRIMACK (Allen 21135, MO)

A. oersteadianum (Müll. Hal.) Mitt.: GRAFTON (392); MERRIMACK (Allen 21824, MO)

A. tenellum (Röhl.) Bruch & Schimp: GRAFTON (393)

A. undulatum (Hedw.) P. Beauv.: GRAFTON (389)

Pogonatum dentatum (Brid.) Brid.: COÖS (Hodgdon 9849, NHA; 1244); GRAFTON (White, 1891); MERRIMACK (Allen 21133, MO)

P. pensilvanicum (Hedw.) P. Beauv.: COÖS (Rel. Farlow. 564); GRAFTON (485); MERRIMACK (Allen 10056, MO); STRAFFORD (Hodgdon & Riedeman 230, NHA); SULLIVAN (Butler, MO)

P. urnigerum (Hedw.) P. Beauv.: COÖS (1250); CHESHIRE (Deane, no date); STRAFFORD (Hodgdon 9746, NHA)

Polytrichastrum alpinum (Hedw.) GL Sm.: CARROLL (1189); COÖS (Allen 1437, MO); GRAFTON (484); MERRIMACK (Andrews, 1915)

Polytrichum commune Hedw.: CHESHIRE (Baldwin, 1968, NHA); COÖS (Wheeler, 1903; 1262); GRAFTON (492); HILLSBOROUGH (Walke, 1968, NHA); MERRIMACK (Allen 21096, MO); STRAFFORD (917)

P. commune var. *perigoniale* (Mx.) Hampe.: STRAFFORD (Prediger, 1969, NHA)

P. formosum Hedw.: GRAFTON (493)

P. juniperinum Hedw.: COÖS (Allen 1436, MO); GRAFTON (494); MERRIMACK (Allen 21808, MO); STRAFFORD (1133)

P. longisetum Brid.: COÖS (Sperduto 6476b); GRAFTON (Welch, 1956, NY)

P. ohioense Ren. & Card.: COÖS (Cummings, 1889); GRAFTON (Hutchinson, MO); MERRIMACK (Hodgdon & Lyman 11492, NHA); ROCKINGHAM (908)

P. pallidisetum Funck.: CHESHIRE (Baldwin, 1968, NHA); COÖS (Rhoades, 1960, NHA); GRAFTON (495); MERRIMACK (Allen 12978, MO)

P. piliferum Hedw.: CHESHIRE (866); COÖS (Sperduto 6642.1); GRAFTON (567); HILLSBOROUGH (805); MERRIMACK (Dirig M-352); STRAFFORD (Riedeman 306, NHA)

P. strictum Brid.: CHESHIRE (Sperduto 7042); COÖS (Allen 1436, MO); GRAFTON (729); MERRIMACK (Allen 21140, MO); STRAFFORD (922)

Pottiaceae

Barbula convoluta Hedw.: GRAFTON (Hutchinson, 1947, NY)

B. unguiculata Hedw.: COÖS (Underwood & Cook, 1889, FH; 1149); GRAFTON (Cummings, 1882, FH; 1354); HILLSBOROUGH (1296); SULLIVAN (998)

Bryoerythrophyllum recurviriostrum (Hedw.) Chen.: COÖS (1534); GRAFTON (1385)

Didymodon fallax (Hedw.) Zand.: GRAFTON (FA Balch, 1894, NY)

Gymnostomum aeruginosum Sm.: COÖS (Sperduto 6107)

Hymenostylium recurvirostrum (Hedw.) Dix.: COÖS (978)

Hyophila involuta (Hook.) Jaeg.: SULLIVAN (1111)

Tortella humilis (Hedw.) Jen.: MERRIMACK (Andrews, 1915)

T. tortuosa (Hedw.) Limpr.: COÖS (Underwood & Cook, 1889, NY); GRAFTON (1378); STRAFFORD (Hodgdon & Riedeman, 1954, NHA)

Trichostomum tenuirostrum (Hook. & Tayl.) Lindb.: BELKNAP (Clayton 540); CARROLL (1180); COÖS (Andrews, 1918; Sperduto 6750.6); GRAFTON (993)

Weissia controversa Hedw.: GRAFTON (Cummings, 1889); HILLSBOROUGH (1456); MERRIMACK (E Moulton, 1886, NY); STRAFFORD (Hodgdon, 1954, NHA)

Pterigynandraceae

Heterocladium dimorphum (Brid.) Schimp.: BELKNAP (Stevens, 1904); CARROLL (Grout, N. Amer. Musci Pleur. 405); COÖS (Wheeler, 1905); GRAFTON (731)

Pterigynandrum filiforme Hedw.: CARROLL (1184); COÖS (Wheeler, 1903; 1544); GRAFTON (Stone 436, MO; 1458); MERRIMACK (Allen 21152, MO)

Ptychomitriaceae

Campylostelium saxicola (Web. & Mohr.) B.S.G.: ROCKINGHAM (Huntington, 1903, NY)

Rhabdoweisiaceae

Amphidium lapponicum (Hedw.) Schimp.: BELKNAP (Clayton, 1930); CHESHIRE (958); COÖS (Hutchinson, 1949, NYS; 1551); GRAFTON (1112)

A. mougeotii (Bruch. & Schimp.) Schimp.: COÖS (Forman B156, NY); GRAFTON (Glime 3141, MCTC)

Rhabdoweisia crispata (With.) Lindb.: COÖS (Allen 169, MO); GRAFTON (722); HILLSBOROUGH (Carlin, 1898; 772)

Schistostegaceae

Schistostega pennata (Hedw.) Web. & Mohr.: CARROLL (Holzinger, Musci Acrocarpi Bor.-Amer. 315, MO); COÖS (Miller 2154, NYS); GRAFTON (Hutchinson, 1958)

Seligeriaceae

Blindia acuta (Hedw.) Bruch. & Schimp.: CARROLL (JA Allen, 1880); COÖS (James, MO); GRAFTON (Lorenz 237, MO; 1057)

Brachydontium trichodes (Web.) Fürnr.: COÖS (Faxon, 1885, FH)

Sematophyllaceae

Brotherella recurvans (Michx.) Fleisch.: COÖS (Andrews, 1918); CHESHIRE (Adams, 1902); GRAFTON (404); MERRIMACK (Allen 13020, MO)

Sematophyllum marylandicum (Müll. Hal.) Britt.: COÖS (Forman, 1960, NY); GRAFTON (518); MERRIMACK (Allen 13027, MO)

Splachnaceae

Splachnum ampullaceum Hedw.: CARROLL (1367); COÖS (Hodgdon, Steele & Allen 11538, NHA); GRAFTON (738); ROCKINGHAM (AA Eaton, 1896)

S. rubrum Hedw.: COÖS (1230)

Tetraplodon angustatus (Hedw.) Bruch. & Schimp.: COÖS (AT Beals, 1918, NY); GRAFTON (739)

T. mnioides (Hedw.) Bruch. & Schimp.: COÖS (Forman B213, NY); GRAFTON (Mathias 233, MO)

Tetraphidaceae

Tetradontium brownianum (Dicks.) Schwaegr.: COÖS (Austin, 1892, FH); GRAFTON (Faxon, 1885, FH)

Tetraphis geniculata Girg. ex Milde.: COÖS (Lorenz 575)

T. pellucida Hedw.: CARROLL (Bartlett 1216, MO); CHESHIRE (867); COÖS (Wheeler, 1905); GRAFTON (544); HILLSBOROUGH (780); MERRIMACK (Quillinan 94-101-42); ROCKINGHAM (Sperduto 4949); STRAFFORD (Riedeman 171, NHA); SULLIVAN (Butler 5479, MO)

Theliaceae

Myurella julacea (Schwaegr.) Schimp.: GRAFTON (1276)

M. sibirica (Müll. Hal.) Reim.: COÖS (977); GRAFTON (1384)

Thelia asprella (Schimp.) Sull. & Lesq.: CHESHIRE (874); HILLSBOROUGH (854); STRAFFORD (913)

T. hirtella (Hedw.) Sull. & Lesq.: HILLSBOROUGH (636); ROCKINGHAM (1596)

Thuidiaceae

Abietinella abietina (Hedw.) Fleisch.: GRAFTON (Faxon, 1897, NY)

Rauiella scita (P. Beauv.) Reim.: BELKNAP (Clayton 852); COÖS (Rel. Farlow. 600); GRAFTON (552); MERRIMACK (Andrews, 1915)

Thuidium delicatulum (Hedw.) Schimp.: COÖS (Engstrom, 1996); GRAFTON (551); HILLSBOROUGH (784); MERRIMACK (Allen 21824, MO); STRAFFORD (927)

T. recognitum (Hedw.) Lindb.: CHESHIRE (Rel. Farlow. 599); GRAFTON (Hutchinson, 1948, NY)

Timmiaceae

Timmia megapolitana Hedw.: COÖS (Sperduto 6678.1)

Acknowledgments. This checklist would not have been possible without the funding and encouragement provided by Tim Fahey from 1994-1996. Funding was also providd by US Forest Service (Dave Funk, Durham, NH) for bryophyte surveys of six Natural Research Areas and from Nature Conservancy and Environmental Protection Agency subcontracts (Dan Sperduto, NHNHI). Bruce Allen provided invaluable comments on the list especially the nomenclature, added many new records to the list from his collections, and brought the new species *Racomitrium aduncoides* to my attention. I thank the curators of the herbaria consulted for this list and I especially thank Bob Dirig of the Bailey Hortorium for handling many loans and providing me with a peaceful place to examine specimens.

Appendix

Species with reliable literature reports of occurrence in New Hampshire, but for which neither Allen (1992) nor I have been able to verify actual specimens:

HEPATOPHYTA

These reports are given by Evans (1917, 1923) and Schuster (1966-1992).

Haplomitrium hookeri (Smith.) Nees.: COÖS (Evans 1917)

Nardia geoscyphus (DeNot.) Lindb.: COÖS (Schuster 23055); GRAFTON (Evans 1907)

N. insecta Lindb.: COÖS (Schuster 68-2102d)

Lophozia excisa (Dicks.) Dum.: CARROLL (Evans 1906)

L. ventricosa var. *longiflora* (Nees.) Macoun.: GRAFTON (Lorenz 1910)

L. ventricosa var. *silvicola* (Buch.) Jones.: COÖS (Schuster 68-2145a, with *L. longidens*)

Riccia arvensis Aust.: GRAFTON (Lorenz 1917)

R. bifurca Hoffm.: SULLIVAN (Lorenz, fide Evans 1917)

R. huebeneriana subsp. *sullivantii* (Aust.) Schust.: SULLIVAN (Haynes 1917)

Scapania hyperborea Joerg.: COÖS (Schuster 68-2102); GRAFTON (Lorenz 1908)

BRYOPHYTA*

These reports are given by Jamieson (1976), Grout (1928-1936, 1940), Ireland (1969), Ireland and Crum (1976), and Rushing (1986).

Hygrohypnum subeugyrium (Ren & Card.) Broth.: White Mts (reported by Jamieson 1976))

Bruchia vogesiaca Schwaegr.: CARROLL (Evans,1889, as *B. longicollis*, DUKE, NY)
Coscinodon cribrosus (Hedw.) Spr.: COÖS (Churchill 4562616, MICH)
Dicranum bonjeani DeNot.: COÖS (Grout, 1939)
Isothecium mysuroides Brid.: CARROLL (reported in Grout 1928-1936)
Taxiphyllum deplanatum (Bruch. & Schimp.) Fleisch.: GRAFTON (Grout July 15, 1903)
Plagiothecium latebricola Bruch. & Schimp.: COÖS (Grout, 1939)
Atrichum altecristatum (Ren. & Card.) Symth. & Symth.: COÖS (Crum & Anderson 7946)
Meesia longiseta Hedw.: COÖS (Grout, 1939)

* It should be noted that the *Scorpidium scorpioides* (Hedw.) Limpr. record included on Allen (1992) list based on literature citation of Lorenz (1906) was incorrect since in this reference Lorenz clearly states that this moss was notably absent from the area around Waterville.

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Aneura maxima (Hepaticae: Aneuraceae) and *Marchantia aquatica* Hepaticae: Marchantiaceae) New to Missouri and Interior Highlands of North America

Carl E. Darigo[1]

Aneura Dum. and *Marchantia* L. are genera of thalloid liverworts predominately found on moist soil, humus, or rocks, generally along streams in forest habitats. *Aneura pinguis* (L.) Dum. and *Marchantia polymorpha* L. have previously been recorded (Gier 1955, Timme & Redfearn 1997) in Misssouri and in the Interior Highlands of North America, i.e., Missouri below the Missouri River, parts of eastern Oklahoma, northern Arkansas, and southern Illinois. This paper adds two new species, *Aneura maxima* (Schiffn.) Steph. and *Marchantia aquatica* (Nees) Burgeff, to Missouri and the Interior Highlands of North America.

> *Aneura maxima* (Schiffn.) Steph. Missouri, Madison County, Mark Twain National Forest, Brant 5523 (MO).

The collection was made 6 September 2003 by Alan Brant while doing a herbaceous plant survey for the Mark Twain National Forest in a remote section of southeast Madison County. This locality occurs in the St. Francois Mountains of the Interior Highlands. The collection site was on a spring-fed tributary of Shetley Creek, five miles west of Marquand, elevation 825 feet. The liverwort grew in scattered, small mats on moist soil of a shaded bank along a spring branch, in an upland oak-hickory forest. Associated with this species was *Fontinalis sphagnifolia* (C. Müll.) Wijk & Marg. Schuster (1992) reports the distribution of *Aneura maxima* in North America as Vermont, New York, Pennsylvania, West Virginia, Tennessee and North Carolina, while Miller (2002) adds Maine and Louisiana.

Aneura maxima has a green thallus, 4 mm wide, much lobed and with archegonia scattered in sinuses; the thallus margins are 1-stratose in a band 10-25 cells wide, and the thick mid-section is approximately 1/3 of total width of the thallus. *Aneura pinguis* has fewer lobes and less archegonia than *A. maxima*, the thallus margins are not 1-stratose, or 1-stratose to 10 cells wide, and the thick mid-section is 2/3 or more of total thallus width. Miller (2002) points out that *A. pinguis* can be highly variable, with one form of variation approaching *A. maxima*. Such lax plants in wet habitats can have lateral margins somewhat similar to *A. maxima*, but without the highly lobed configuration, and *A. pinguis* still retains the wide, thick, central thallus region and irregularly placed archegonial branches. Miller (2002) also indicates that in the northern portion of its eastern North American range, *A. maxima* has been found on wet peat in fens and wet muck with shrub overstory, while in the southern section, the plants occur exclusively on wet rock in streams, over cliff faces and on stream banks, as did the Brant collection. In addition to the above species characteristics, Schuster (1992) describes *A. maxima* as light green, translucent and with fewer oil bodies in epidermal cells, while *A. pinguis* is greasy, opaque and with more oil bodies. Except for the translucent thallus margins of *A. maxim*a, the author could not fully confirm these latter differences in comparison with known *A. pinguis* material.

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Marchantia aquatica (Nees) Burgeff Missouri, Washington County, Brant 5528 (MO)

The collection was made 1 October 2003 by Alan Brant on adjacent private property, while doing a herbaceous plant survey for the Mark Twain National Forest in a remote section of southwest Washington County. This locality is in the Salem Plateau of the Interior Highlands, but very close to the St. Francois Mountains region. The collection site was on a spring-fed tributary of Cub Creek, four miles east of Courtois, elevation 1,000 feet. The plants grew in dense mats covering an area of 25 square yards on shaded moist soil and limestone bedrock, at base of small waterfall of stream in an upland oak-hickory forest. Associated species were *Fissidens grandifrons* Brid., *Rhizomnium punctatum* (Hedw.) T. Kop. and *Leptodictyum riparium* (Hedw.) Warnst. var. *laxirete* (Card. & Thér.) Grout. Schuster (1992) reports the North American distribution of *Marchantia aquatica* as Newfoundland, Quebec, Vermont, Massachusetts, New York and Michigan.

Marchantia aquatica has a green thallus, 7-8 mm wide, with the polygonal surface pattern and air pores only somewhat visible. Its dark-black, wide, continuous mid-stripe is strongly visible over the entire length of the thallus dorsal surface. The ventral scale appendages are entire. Only one gemmae cup was found in the material examined. The black pigmentation in this species results from a lack of air chambers below the mid-stripe. *Marchantia polymorpha* has a very weakly visible, interrupted mid-stripe, serrate ventral scale appendages and usually numerous gemmae cups. Schuster (1992) comments that *M. polymorpha* usually occurs in disturbed habitat, while *M. aquatica* normally is found in more natural areas, forming mats along edges of streams or on rock in stream beds; this latter type of habitat is consistent with that of the Brant collection.

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Vertical Distribution of Liverworts within the Forest Canopy in the Southern Appalachians: Contribution to the All Taxa Biodiversity Inventory of the Great Smoky Mountains National Park.

Paul G. Davison[1] & Harold W. Keller[2]

Abstract. Bark samples collected from 110 phorophytes in the Great Smoky Mountains National Park yielded 21 species of epiphytic liverworts higher than 3.5 m above ground level. Species richness of liverworts declined with height above ground. *Frullania* spp., *Lejeunea ulicina*, *Metzgeria* spp., and *Porella platyphylla* occurred more frequently in tree canopies than on lower tree trunks.

This paper is part of a tree canopy study headquartered at Central Missouri State University (CMSU) (see http://faculty.cmsu.edu/myxo/). One objective is to identify the cryptogams found in the forest canopy in the Great Smoky Mountains National Park (GSMNP) and as such is very much aligned with, and is part of, the All Taxa Biodiveristy Inventory (ATBI) currently underway in the Park (see www.dlia.org). The GSMNP is located within the biologically diverse southern Appalachians and is a center of biological diversity as acclaimed by its status as an International Biosphere Reserve and a World Heritage Site. The ATBI is an attempt to document all life forms within the GSMNP by answering three basic questions: "1. What is it? 2. Where is it? 3. What does it do?" (Sharkey 2001, p. 556). This is an ambitious, long-term project that has captured the imagination of professional researchers, students, and the general public (see Kaiser 1999; Pedersen 1999; Sharkey 2001).

The forest canopy project organized by H.W. Keller offers a unique opportunity for the study of diverse biological groups from little studied southern Appalachian forest canopies. Canopy bark samples supporting epiphytic communities collected by CMSU graduate and undergraduate students were studied by numerous specialists in diverse fields (e.g. entomology, tardigradology, pteridology, mycology, myxomycology, bryology, lichenology).

Published results from the canopy study include those for plasmodial slime molds (Keller et al. 2004; Snell et al. 2003; Snell & Keller 2003) and lichens (Ciegler et al. 2003).

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Also, from a single large yellow poplar tree (*Liriodendron tulipifera*) a canopy dwelling fern and the vertical distribution of associated bryophytes were reported (Keller et al. 2003).

In addition to cryptogams, the canopy project has also contributed to the study of invertebrates in the GSMNP (see Keller et al. 2003 for the report of a flightless insect proturan species). Most of the invertebrate research has focused on tardigrades (water bears) extracted from canopy dwelling mosses. Several hundred Hoyer mounts prepared largely by undergraduate students preserving tardigrades from canopy samples have been sent to tardigrade specialists for identification. A preliminary report of the tardigrades found in the moss *Ulota crispa* is found in Hooie et al. (2001). Many canopy bark samples with epiphytic bryophytes and lichens are available for tardigrade extraction. We encourage anyone interested in studying invertebrates from canopy samples or in participating in other aspects of this ATBI canopy project to contact H. W. Keller.

Tree canopy is defined as a vertical transect beginning at 3.5 m and extending into the crown or tops of living trees. Canopy structure is the organization in space and time of the above ground components of the vegetation (Parker 1995). This more general definition allows for the entire above ground plant to be within the forest canopy. The tree canopy in our sense is essentially the height above ground beyond which most people cannot reach, unassisted, while standing on the ground. To our knowledge this study is the first to document the assemblage of liverwort species inhabiting tree canopies in the southern Appalachians.

Methodology

Tree Access by Rope Climbing

Methodologies for accessing the tree canopy include hot air balloons, dirigibles, cranes with gondolas, cherry pickers, elevated platforms or walkways, inflatable platforms, tree houses or bridges, ladders, towers, free hand climbing and rope climbing techniques (Moffett and Lowman, 1995; Lowman, 1999). Our tree canopy studies employed the double rope climbing technique for several reasons (Jepson, 2000). The necessary equipment is minimal, enabling each climber to pack the entire set of climbing gear in a standard backpack. This in turn provided for more mobility when hiking over long distances and quick use at specific sites. In addition, the double rope method allows the climber to advance the rope to higher branches, often reaching near the top of the tree (Keller, 2002).

Tree Canopy Sampling Methods

In addition to special training in the double rope climbing technique, all student climbers were given tutorials that included lecture slide shows, demonstration specimens, practice keying, and field experience with taxonomic specialists (mycologists, a lichenolgist, and bryologists). This training enabled the student climbers to recognize and collect the targeted groups of organisms.

Each climber used an elevation line marked off in 1 ft increments attached to their climbing harness to determine height measurements. Total tree height was measured by the climber as the sum of height climbed and the estimated remaining height to the tree top. During climbing bark supporting epiphytes was scraped or pried from the trunk using a large knife, taking care not to damage the underlying living tissues of the tree. Efforts were made to sample from all sides of the trunk. All samples were collected from living parts of the tree and placed in labeled paper bags. Bark samples were taken at irregular height intervals and sample heights were recorded to the nearest foot. To obtain a uniform vertical profile, an attempt was made to take bark samples at roughly 3-m intervals. Given differences in tree climber's ability and the limitations of the double rope climbing technique used, samples were not always collected within 3-m intervals and climbers were sometimes prevented from climbing to near the top of tree. In the evenings following collecting a subsample of many of the bark chips containing bryophytes were segregated and placed into hand-labeled paper bags. This report is based on those segregated specimens. Other bark chips possessing bryophytes do remain unexamined for bryophytes as they were segregated for study of either lichens or slime molds.

Individual trees were selected from geographically different areas of the park with most trees included in this report being chosen from along the northern boundary of the park in Tennessee. Bark samples were collected from sites ranging in elevation from ca. 1500-5500 ft. elevation. More than 90% of the trees were from sites below 3000 ft. elevation and were within pine-oak or cove hardwood forests. Due to access and climbing restraints, random selection of trees was not practical. Only living trees in a healthy condition were selected for climbing. All collections reported were made during the summer of 2000.

All available bark samples were carefully examined under the dissecting microscope for the presence of liverworts. When necessary for species identification slide wet mounts and compound microscope examinations were made. Voucher specimens of all liverworts are at UNAF.

Results and Discussion

Bark samples from 108 trees and two grape vines were included in this study (Table 1). For simplicity, all 110 phorophytes may be referred to as "trees" hereafter. It should be noted that additional trees were sampled during 2000 by the CMSU climbers (see Ciegler et al. 2003), but bark samples from these were either not available for this study or did not contain liverworts. The percentage of the total tree height reached by the climbers was quite variable. It is impressive that a number of 30+ m tall trees were climbed and sampled within 85% or more of the total tree height; however, for a few trees less than 50% of the total tree height was reached by the climbers. The average total height of the various phorophytes in this study and the maximum height above ground sampled are given in Table 1.

For purpose of data analysis, field data recorded in feet were converted and pooled into 4 m intervals with the exception of the lower tree trunk data that was pooled for 0 - 3.4 m above ground. The total number of trees sampled for each interval is as follows: 65 trees at 0 - 3.4 m, 75 trees at 3.5 - 7.4 m, 79 trees at 7.5 – 11.4 m, 70 trees at 11.5 – 15.4 m, 52 trees at 15.5 – 19.4 m, 36 trees at 19.5 – 23.4 m, 14 trees at 23.5 – 27.4 m, 10 trees at 27.5 – 31.4 m, and 1 tree at 31.5 – 35.4 m. The total number of height intervals sampled across all trees was 402.

The segregated bryophyte samples were sorted into approximately 600 standard bryophyte packets. Given that each packet contained multiple pieces of bark, 1000's of multifaceted bark chips were carefully examined under the dissecting microscope for the presence of liverworts. Many of the liverworts recorded were present in minute quantities. Often only a single shoot was found either as an isolated fragment or admixed in mosses or other liverworts. Many of the liverworts were identifiable on sight through the dissecting microscope. *Frullania*'s presented an identification problem in that the few shoots often present lacked sexual structures needed for positive identification or were too poorly developed to be reliably identified beyond genus (although, it is most probable that the unidentified *Frullania*'s belong to either *F. eboracensis* or *F. brittoniae*). Also, scraps of *Metzgeria* often bearing marginal gemmae but main thalli depauperate and usually without midrib development were not identified to species although many of these specimens are likely *Metzgeria furcata*. Scraps of *Radula* bearing marginal gemmae but lacking sexual structures were also not identified to species. These specimens likely belong to *R. complanata*, *R. lindbergiana*, or *R. australis*.

Twenty-one species of liverwort in 13 genera were found in the forest canopy 3.5 m or more above ground in the GSMNP (Table 2). For purposes of counting species, it is

Table 1. Phorophytes climbed found supporting canopy liverworts and the maximum height above ground (ft) from which collections (with or without liverworts) were made.

Phorophyte	Number climbed	Average Total Height (m)	Maximum height (m) of bark collections
Acer rubrum	8	25.9	25.9
Acer saccharinum	1	(not avail.)	7.9
Acer saccharum	2	30.5	19.2
Acer sp.	3	25.2	13.7
Aesculus flava	5	30.5	30.5
Betula alleghaniensis	2	19.5	15.8
Carya cordiformis	1	23.8	11.6
Carya glabra	4	30.0	28.4
Carya tomentosa	1	24.4	14.3
Cornus florida	1	7.6	4.3
Fagus grandifolia	3	10.8	9.1
Fraxinus americana	5	21.8	20.1
Gleditsia triacanthos	1	25.9	23.2
Halesia tetraptera	5	30.1	27.4
Juglans nigra	5	25.2	20.1
Juniperus virginiana	2	8.4	7.3
Liquidamber styraciflua	7	27.3	28.0
Liriodendron tulipifera	4	28.2	12.5
Magnolia acuminata	2	34.3	30.2
Nyssa sylvatica	1	22.9	16.2
Pinus strobus	1	36.0	35.1
Platanus occidentalis	2	30.5	22.9
Prunus serotina	1	19.5	14.6
Quercus alba	15	28.1	21.3
Quercus prinus	4	24.2	20.7
Quercus rubra	1	33.5	22.2
Quercus sp.	1	25.6	9.8
Quercus velutina	1	27.4	17.1
Robinia pseudo-acacia	1	27.4	20.1
Sorbus americana	1	12.2	9.8
Tilia americana	10	27.7	29.0
Tsuga heterophylla	2	31.1	29.0
Ulmus americana	3	10.7	12.5
Ulmus rubra	1	22.9	18.9
Vitis aestivalis	3	25.0	26.5

Table 2. Liverworts occurring 3.5 m or more above ground on 110 phorophytes in the GSMNP and their percentage of occurrence detected in all height intervals sampled.

Liverwort taxon	%	Vertical distribution and abundance. Column headings are m above ground; row data indicate number of trees where found.							
		0-3.4	3.5-7.4	7.5–11.4	11.5–15.4	15.5–19.4	19.5–23.4	23.5–27.4	27.5–31.4
Anastrophyllum michauxii (Web.) Buch ex Evans	<1	1	2	1	0	0	0	0	0
Cololejeunea biddlecomiae (Aust.) Evans	6	15	5	1	1	1	0	0	0
Frullania asagrayana Mont.	14	9	9	8	13	8	7	2	0
Frullania brittoniae Evans	5	2	2	7	5	3	1	0	0
Frullania eboracensis Gott. subsp. *eboracensis*	18	7	11	16	19	13	5	2	1
Frullania ericoides (Nees) Mont.	5	6	5	6	4	1	0	0	0
Frullania inflata Gott.	<1	0	2	0	0	0	0	0	0
Frullania sp.	31	18	27	28	20	17	9	4	0
Harpalejeunea ovata subsp. *integra* Schust.	2	2	3	4	0	0	1	0	0
Herbertus aduncus subsp. *tenuis* (Evans) Miller & Scott	<1	1	1	0	0	0	0	0	0
Lejeunea ruthii (Evans) Schust.	4	7	4	3	3	0	0	0	0
Lejeunea ulicina (Tayl.) Gott.	20	11	15	19	17	12	4	1	0
Lejeunea sp.	<1	0	0	1	0	0	0	0	0
Leucolejeunea clypeata (Schwein.) Evans	2	6	3	0	0	0	0	0	0
Leucolejeunea unciloba (Lindenb.) Evans	<1	1	0	1	1	0	0	0	0
Leucolejeunea sp.	<1	0	1	0	1	0	0	0	0
Metzgeria crassipilis (Lindb.) Evans	3	1	2	2	2	2	3	1	0
Metzgeria sp.	13	7	10	11	10	5	6	2	0
Nowellia curvifolia (Dicks.) Mitt.	<1	0	0	0	1	0	0	0	0
Porella platyphylla (L.) Pfeiff.	14	6	11	14	12	5	4	3	0
Radula obconica Sull.	<1	2	0	1	0	0	0	0	0
Radula sp.	13	19	11	10	8	2	1	0	0
Scapania nemorea (L.)Grolle	<1	0	0	0	1	0	0	0	0
Tritomaria exsecta (Schrad.) Loeske	<1	0	1	1	1	0	0	0	0

assumed that *Frullania* sp, *Lejeunea* sp., and *Leucolejeunea* sp. represent species already listed while *Metzgeria* sp. and *Radula* sp. belong to 1 or more species not listed. As a measure of liverwort abundance or rarity, the percentage of occurrence out of a possible 402 sampled height intervals totaled for all 110 phorophyte "hosts" is also presented in Table 2. Table 2 also presents vertical distribution data.

Given the limitations of field methods and the necessity to divide bark samples into bryophyte, lichen, or slime mold segregates, the data presented is a rather crude representation of the vertical distribution of liverworts. Nonetheless, in seems clear that the following liverworts are more frequent in tree canopies than on tree trunks 3.4 m or closer to the ground: *Frullania* spp., *Lejeunea ulicina*, *Metzgeria* spp., and *Porella platyphylla*. Of these, only *Frullania brittoniae* and *F. eboracensis* are near obligate epiphytes. All are tolerant of desiccation and exposure to high light intensities..

The number of species found within each of the 4-m vertical height intervals as defined in Table 2 is (ordered by height from lowest to highest): 17, 17, 15, 16, 10, 9, 6, and 1. The greatest height above ground from which a liverwort was found was 28 m—*Frullania eboracensis* in the canopy of a *Tilia americana*. Even with the limitations in sampling procedure it seems clear that *Frullania* is the most frequent liverwort in the forest canopy. Of the 402 sampled height intervals for all 110 phorophytes *Frullania* was detected in 297 or 74 %.

Even though a few species were not found in the lowest height interval, the data in Table 2 cannot be used to suggest that southern Appalachian tree canopies have liverwort species restricted to them. This is in contrast to certain tropical rainforests where many epiphytic bryophyte species are restricted to the tree crowns (Gradstein et al. 1996).

Unexpectedly, as these species are only rarely found on trees in the Park, *Nowellia curvifolia* and *Scapania nemorea* were found in a single collection from a *Betula alleghaniensis* 11+ m above the ground. These and the rare canopy occurrences detected for *Anastrophyllum michauxii*, *Herbertus aduncus* subsp. *tenuis*, and *Tritomaria exsecta* all occurred on the same tree found at 5500 ft elevation. The added diversity is surely a reflection of increased elevation. Sampling of additional trees at the higher elevations (4000 – 6600 ft.) should add additional species to those currently documented in the forest canopy of the GSMNP.

An analysis of possible association between forest type and canopy liverworts is not included here, but surely forest type and other environmental factors at both the macro (e.g. elevation, topography) and micro (e.g. bark characteristics) levels have an effect on the diversity of canopy liverworts; see Bates (2000), McCune et al. (2000), and Rhoades (1995) for discussion of environmental factors affecting epiphytic communities; Gradstein et al. (1996) and Acebey et al. (2003) are also valuable references.

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A Checklist of the Lichens Collected on the 28th A. Leroy Andrews Foray

James C. Lendemer [1] & Richard C. Harris [2]

Abstract. A checklist of the lichens collected during the 28th Leroy Andrews Foray in Connecticut, USA is provided. *Epigloea intermedia* Döbbeler is reported as new to North America and *Dictyocatenulata alba* Finley & E.F. Morris is recognized as a lichen forming fungus. The genus *Chromatochlamys* Trevisan is placed in synonymy with *Thelenella* Nylander.

September 19-21, 2003 the participants of the 28th A. Leroy Andrews Foray collected bryophytes and lichens in the region surrounding Sharon, Connecticut, USA. A list of the lichens collected during the foray by the following individuals is provided (the herbaria in which their collections are deposited follow their names): W.R. Buck (NY), D. Flenniken (hb. Flenniken), R.C. Harris (NY), E. Lay (hb. Lay), J.C. Lendemer (hb. Lendemer), P. May (hb. May), R.S. Olszewski (hb. Olszewski).

The following list is arranged chronologically by the localities visited during the foray. A list of the species collected at each locality is provided and arranged alphabetically by genus and species. It will be noted that specimens identified only to genus are also included and that nomenclature does not consistently follow the current North American checklist (Esslinger, 1997) nor recent monographic works. Instead, the names used here reflect the preferences of the collectors. Too, all identifications are those of the collectors and not the work of any one individual.

1) Litchfield County: Town of Canaan, Great Mountain Forest, Sam Yankee Woodlot, E of Canaan Mountain Road, Lat. 41°, 57', 13"N, Long. 73°, 16', 35"W; mixed hardwood-conifer forest. 20 September 2003.

Acarospora fuscata (Nylander) Arnold – *Harris 48003, Lay 03-0030, Olszewski 5936B.*
Allocetraria oakesiana (Tuckerman) Randlane & Thell – *Flenniken 6151, Lay 03-0038, Lay 03-0039, Lendemer 1374, Olszewski 5929.*
Amandinea polyspora (Willey) E. Lay & P. May *in* Sheard & P. May – *Lendemer 1343, Lendemer 1369.*

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Amandinea punctata (Hoffmann) Coppins & Schneider – *Lendemer 1647.*

Anaptychia palmulata (Michaux) Vainio – *Flenniken 6152.*

Arthonia helvola (Nylander) Nylander – *Buck 45030a.*

Aspicilia sp. – *Lendemer 1371.*

Aspicilia caesiocinerea (Nylander *ex* Malbr.) Arnold – *Lay 03-0040.*

Aspicilia cinerea (L.) Körber – *Harris 48004.*

Biatora longispora (Degelius) Lendemer & Printzen *in press.* – *Buck 45025, Harris 48005, Lendemer 1370, Lendemer 1638, Olszewski 5928.*

Candelariella efflorescens R.C. Harris & Buck – *Olszewski 5951B.*

Chrismofulvea dialyta (Nylander) Marbach – *Harris 48006, Lay 03-0046, Lay 03-0047, Lay 03-0048, Lay 03-0049, Lendemer 1344, Olszewski 5927.*

Cladonia carneola (Fries) Fries – *Harris 48007.*

Cladonia coniocraea (Flörke) Sprengel – *Flenniken 6153, Olszewski 5950.*

Cladonia dimorphoclada Robbins – *Harris 48009, Olszewski 5952.*

Cladonia furcata (Hudson) Schrader – *Harris 48011, Olszewski 5942.*

Cladonia gracilis (L.) Willdenow ssp. *turbinata* (Acharius) Ahti – *Harris 48012, May 450-1.*

Cladonia grayi G. Merrill *ex* Sandstede – *Harris 48013.*

Cladonia macilenta Hoffmann – *Harris 48014.*

Cladonia parasitica (Hoffmann) Hoffmann – *Harris 48015.*

Cladonia phyllophora Hoffmann – *Olszewski 5957C.*

Cladonia rangiferina (L.) F. H. Wiggers – *Harris 48016, Lendemer 1360, Olszewski 5945, Olszewski 5951, Olszewski 5953B.*

Cladonia sobolescens Nylander – *Harris 48017.*

Cladonia squamosa Hoffmann – *Harris 48018, Lendemer 1636, Olszewski 5941, Olszewski 5943, Olszewski 5944.*

Cladonia strepsilis (Acharius) Grognot – *Harris 48021, Olszewski 5947, Olszewski 5955, Olszewski 5957B, Olszewski 5958.*

Cladonia subtenuis Abbayes – *Harris 48022.*

Cladonia turgida Hoffmann – *Olszewski 5957E.*

Cladonia uncialis (L.) F. H. Wiggers – *Harris 48023, Olszewski 5957, Olszewski 5957D.*

Dictyocatenulata alba Finley & E.F. Morris – *Buck 45006, Buck 45030.*

Superfically *Dictyocatenulata alba* resembles a whitish member of the Caliciales such as *Sclerophora* Chevall. However, when studied microscopially the "mazaedium" is found to consist of ± globose multicellular conidia.

The second author first collected this species over 35 years ago and has since seen a number of additional collections without ever finding an available name. When examining the collections made during the Andrews Foray he again was confronted with this species, and thus began to search once again for a name. Because it seemed to be common it should have been described, and a search through the excluded taxa of Stilbum s. lat. (which Dictyocatenulata resembles) in Seifert's (1985) revision of Stibella finally yielded the name Stilbum glomerulisporum Ellis & Everhart ined., which was later described as Dictyocatenulata alba Finley & E.F. Morris. Comparison with original material of both Stilbum glomerulisporum (North American Fungi #3597) and Dictyocatenulata alba (Reliquiae Farlowianae #200a) at NY quickly confirmed the identification. It is interesting that neither Ellis nor Everhart ever validated the name S. glomerulisporum, and that it was not validly described by Morris & Finley (1967) nearly 70 years after the original publication of the name. Seifert et al. (1987) also provided a detailed redescription of the species with excellent photographic and line illustrations. We recommend that anyone attempting to confirm a specimen of D. alba refer to that publication.

It is puzzling that this species has not previously been recognized as a lichen forming fungus. We suspect however, that collectors of Caliciales have been puzzled by it and subsequently discarded their collections of the species. To the lichenologist's eye D. alba possesses an obvious thallus and in all specimens the algal partner Trentepohila is present, usually in abundance. The discovery of two collections on rock also clearly suggests lichenization. Seifert et al. (1987) were puzzled as to Dictyocatenulata's lifestyle noting "...the presence of hyphae within cells of the bark suggests it is a parasite of living cells. ...The extremely restricted growth of D. alba in culture might suggest that it possesses unusual nutritional requirements often associated with parasites." The restricted growth of D. alba in culture is yet another suggestion of lichenization. We strongly recommend the inclusion of Dictyocatenulata in lichen checklists and await the discovery of further records. Too, it should be noted that D. alba has never been found with a possible telemorph. We hope that eventually it is sequenced and its phylogenetic position revealed.

The range of *D. alba* as recorded by Seifert et al. (1987) included specimens from North America, Cuba, Panama, India, and Japan. Within North America, they reported the species from Maine, Massachusetts, New Hampshire, New York, and Ontario. Additional records cited below (all at NY unless otherwise indicated) extend the range to include Michigan, New Jersey, North Carolina, Pennsylvania, and Wisconsin. Specimens of this species will be widely distributed from PH as *Lichenes of Eastern North America Exsiccati III: 147.*

Specimens Examined.: CONNECTICUT. Windham County: Town of Ashford, Yale Forest along Boston Hollow Road, 41°55'42"-56'11"N, 72°09'31"W, ca. 260 m, conifer-hardwood swamp and adjacent dry slope with hemlock, 24 Jul 2002, *Buck 42234*. MAINE. Franklin County: Rangeley, Aug 1904, *Farlow s.n.* MICHIGAN. Chippewa County: Upper Tahquamenon Falls, on rock, 5 Aug 1967, *Harris s.n.*, Sugar Island, 10 Jul 1967, *Mazzer & Goos s.n.*; Delta County: ca. 1.6 mi from Portage Bay Campground, T.39N, R.18W, sec. 32, base of yellow birch, 17 Sep 1976, *Harris 11878.* NEW HAMPSHIRE. Coos County: White Mountain National Forest, Mt. Washington, along Auto Road near Mile Post 2.5, 44°18'N, 71°17'W, ca. 900 m, Abies-hardwood forest, 17 Sep 1999, *Buck 36133.* NEW JERSEY. Hunterdon County: Mitchell property, between Upper Creek and Pine Hill Rds., ca. 40°25'N, 74°56'W, 280-380 ft, hemlock and hardwoods along Wickecheoke Creek, on base of large *Quercus*, 4 Nov 1992, *Harris 29041.* NEW YORK. Onondaga County: Jamesville, Oct 1887, *O. F. Cooke* [incompletely cited by Seifert et. al]; Putnam County: Town of Putnam Valley, between Putnam Valley Elementary School and Canopus Creek, 41°22'N, 73°53'W, 60-150 m, oak dominated hardwoods, 27 Oct 1998, *Buck 35196*; Ulster County: Catskill Park, trail to Belleayre Mt. from Lost Cove Trail Head Parking Area, 42°05'N, 74°28'W, 450-700 m, mixed hardwoods, on *Quercus*, 10 May 1996, *Harris 38481-A.* NORTH CAROLINA. Graham County: Nantahala National Forest, Cherohala Skyway (NC 143), Mudd Gap, 35°20'N, 84°02'W, 1388 m, *Fagus* dominated hardwood forest, on *Betula*, 1 Oct 1997, *Buck 32552.* PENNSYLVANIA. Carbon County, Drakes Creek Gorge, Lehigh Gorge State Park, on *Betula*, 16 Oct 2003, *Lendemer & Moody 1425* (hb. Lendemer). WISCONSIN. Oneida County, Town of Enterprise, Oneida County Forest, 45°28'22"N, 89°21'54"W, ca. 500 m, upland mixed hardood forest, on rock, 27 Apr 2002, *Buck 41636*, Town of Minocqua, Patterson Hemlocks State Natural Area, 45°53'51"N, 89°57'45"W, ca. 500m, hemlock-hardwood forest, 29 Apr 2002, *Buck 41745.*

Dimerella pineti (Acharius) Vèzda – *Lay 03-0058, Lendemer 1342.*

Diploschistes actinostomus (Acharius) Zahlbruckner – *Olszewski 5953.*

Diploschistes scruposus (Schreber) Norman – *Lay 03-0059, Lendemer 71373.*

Epigloea intermedia Döbbeler – *Buck 45023* (algae over *Cladonia* spp.) This species is here reported for the first time for North America. *Epigloea* Zukal is a genus of highly adapted algal parasites (Döbbeler, 1984) but often included in lichen checklists. *Epigloea intermedia* is distinguished by 16-spored asci differing from the two previously reported species, *E. pleiospora* Döbbeler (asci ± 32-spored) and *E. soleiformis* Döbbeler (asci 8-spored). The ascospores of *Buck 45023* are somewhat longer in proportion to width (12.5-15 x 3.5-4.5 μm) than described by Döbbeler [(6-)9-12.5(-14) x 3-4 μm].

Epigloea pleispora Döbbeler – *Buck 44984* (algae on *Sphagnum*), *Buck 44986* (algae on *Polytrichum*), *Lay 03-0163.*

Evernia mesomorpha Nylander – *Olszewski 5940.*

Flavoparmelia baltimorensis (Gyelnik & Fóriss) Hale – *Flenniken 6154.*

Flavoparmelia caperata (L.) Hale – *Flenniken 6155, Olszewski 5931.*

Graphis scripta (L.) Acharius – *Flenniken 6156, Lay 03-0061, Olszewski 5932.*

Hypogymnia physodes (L.) Nylander – *Flenniken 6157, Lendemer 1402, Olszewski 5949.*

Imshaugia aleurites (Acharius) S.F. Meyer – *Flenniken 6158.*

Lasallia papulosa (Acharius) Llano – *Harris 48024, Lay 03-0065, Olszewski 5954.*

Lecanora albella (Persoon) Acharius var. *rubescens* (Brodo & Imshaug) Lumbsch – *Flenniken 6160, Olszewski 5939.*

Lecanora hyocarpa (Tuckerman) Brodo – *Flenniken 6159.*

Lecanora strobilina (Sprengel) Kieffer – *Buck 45018, Lay 03-0067.*

Lecanora symmicta (Acharius) Acharius – *Lendemer 1400.*

Lecanora thysanophora R.C. Harris – *Lendemer 1350, Lendemer 1353.*

Lecidea cyrtidia Tuckerman – *Harris 48025.*

Lepraria caesioalba (de Lesdain) J. R. Laundon – *Buck 44983.*

Lepraria elobata Tønsberg – *Harris 48026.*

Lepraria lobificans Nylander – *Flenniken 6161, Harris 48027.*

Lepraria neglecta (Nylander) Erichsen – *Flenniken 6162*

Lepraria neglecta (Nylander) Erichsen *s. lat.* – *Harris 48028* (corticolous).

Leproloma membranaceum (Dickson) Vainio – *Flenniken 6173.*

Leptogium cyanescens (Rabenhorst) Körber – *Harris 48029.*

Melanelia subaurifera (Nylander) Esslinger – *Flenniken 6163, Lendemer 1347, Lendemer 1377, Lendemer 1401, Olszewski 5945a.*

Micarea peliocarpa (Anzi) Coppins & R. Santesson – *Lendemer 1387.*

Mycocalicium subtile (Persoon) Szatala – *Lay 03-0072.*

Myelochroa aurulenta (Tuckerman) Elix & Hale – *Lendemer 1380.*

Nectriopsis parmeliae (Berkeley & Curtis) M. S. Cole & D. Hawksworth* – *Buck 45008* (on *Punctelia rudecta*), *Harris 48046* (on *Flavoparmelia caperata*).

Parmelia squarrosa Hale – *Flenniken 6164, Olszewski 5948.*

Parmelia sulcata Taylor – *Flenniken 6165.*

Parmeliopsis capitata R.C. Harris *ex* Hinds & P. Hinds – *Lendemer 1406.*

Pertusaria amara (Acharius) Nylander – *Harris 48030, Lay 03-0031.*

Pertusaria rubefacta Erichsen – *Harris 48031.*

Pertusaria trachythallina Erichsen – *Harris 48032, Lay 03-0032.*

Pertusaria velata (Turner) Nylander – *Harris 48033, Lay 03-0033, Lay 03-0077.*

Phaeophyscia rubropulchra (Degelius) Essingler – *Flenniken 6166, Lendemer 1381, Olszewski 5926.*

Physcia phaea (Tuckerman) J.W. Thomson – *Flenniken 6167.*

Placynthiella icmalea (Acharius) Coppins & P. James – *Harris 48034.*

Placynthiella uliginosa (Schrader) Coppins & P. James – *May 450-2.*

Porpidia albocaerulescens (Wulfen) Hertel & Knoph – *Flenniken 6168, Harris 48035, Lay 03-0084, Lendemer 1644, Olszewski 5934.*

Porpidia crustulata (Acharius) Hertel & Knoph – *Olszewski 5935.*

Porpidia macrocarpa (DeCandolle) Hertel & A.J. Schwab – *Harris 48036.*

Porpidia tahawasiana Gowan – *Harris 48037, Lay 03-0081, Lay 03-0091.*

Punctelia rudecta (Acharius) Krog – *Flenniken 6169, Olszewski 5930.*
Pyrenula pseudobufonia (Rehm) R.C. Harris – *Buck 45000.*
Pyxine sorediata (Acharius) Montagne – *Lendemer 1348.*
Rhizocarpon reductum Th. Fries – *May 450-3, Lay 03-0087, Lay 03-0088.*
Rhizocarpon rubescens Th. Fries – *Harris 48038, Lendemer 1389, Lendemer 1390, May 450-3.* The spores of *May 450-3* fall into the range of the norstictic acid containing variety of *R. reductum.*
Rinodina efflorescens Malme – *Harris 48039.*
Ropalospora chlorantha (Tuckerman) S. Ekman – *Flenniken 6172.*
Stereocaulon glaucescens Tuckerman – *Harris 48041, Lendemer 1635, Lendemer 1637, May 450-5.*
Stereocaulon saxatile H. Magnusson – *May 450-3.*
Trapelia sp. – *Buck 44989, Harris 48042.*
Trapeliopsis viridescens (Schrader) Coppins & P. James – *Lay 03-0095.*
Umbilicaria mammulata (Acharius) Tuckerman – *Lay 03-0097, Olszewski 5937.*
Xanthoparmelia conspersa (Acharius) Hale – *Lendemer 1351, Olszewski 5936.*
Xanthoparmelia plittii (Gyelnik) Hale – *Flenniken 6170, Harris 48043.*
Xanthoparmelia somloensis (Gyelnik) Hale – *Flenniken 6171, Harris 48044, Lendemer 1349, Lendemer 1355, Lendemer 1382.*

2) Litchfield County: Town of Norfolk, Holleran Swamp Preserve, E of Elmore Road, 0.3 mi N of CT 272, Lat. 42°, 02', 19"N, Long. 73°, 12', 23"W; hardwood-conifer swamp. 20 September 2003.

Allocetraria oakesiana (Tuckerman) Randlane & Thell – *Flenniken 6175.*
Amandinea polyspora (Willey) E. Lay & P. May *in* Sheard & P. May – *Harris 48052, Lendemer 1385, Lendemer 1397, Lendemer 1639, Olszewski 5975b.*
Arthonia sp.*– *Lendemer 1398* (on *Arthonia caesia*).
Arthonia caesia (Flotow) Körber – *Harris 47944, Lendemer 1413.*
Biatora longispora (Degelius) Lendemer & Printzen *in press.* – *Buck 44928, Lendemer 1386.*
Bryoria furcellata (Fries) Brodo & D. Hawksworth – *Buck 45038.*
Candelariella efflorescens R.C. Harris & Buck – *Harris 48055.*
Chaenothecopsis debilis (Smith) Tibell – *Buck 44942, Lay 03-0114.*
Chrismofulvea dialyta (Nylander) Marbach – *Buck 44929, Harris 48054, Lay 03-0044, Lay 03-0045, Lendemer 1372.*
Cladonia caespitica (Persoon) Flörke – *Buck 44944.*
Cladonia coniocraea (Flörke) Sprengel – *Flenniken 6176, Flenniken 6177.*
Cladonia cylindrica (A. Evans) A. Evans – *Harris 48056.*

Cladonia incrassata Flörke – *Buck 44934, Harris 47946.*

Cladonia macilenta Hoffmann – *Olszewski 5967.*

Cladonia ochrochlora Flörke – *Harris 47947.*

Cladonia squamosa Hoffmann – *Harris 47948, Olszewski 5968.*

Cornutispora sp.* – *Harris 48073* (on *Lecanora pulicaris*).

Dimerella pineti (Acharius) Vèzda – *Buck 44933.*

Distopyrenis americana Aptroot – *Buck 44941, Harris 47950*

Evernia mesomorpha Nylander – *Flenniken 6178..*

Flavoparmelia caperata (L.) Hale – *Flenniken 6179, Harris 47951, Olszewski 5972.*

Fuscidea arboricola Coppins & Tønsberg – *Harris 48058, May 451-7.*

Fuscidea pusilla Tønsberg – *Harris 47953.*

Graphis scripta (L.) Acharius – *Flenniken 6180, Harris 47954, Lay 03-0062.*

Hypocenomyce friesii (Acharius) P. James & Gotth. Schneider – *Buck 45049, Harris 47955.*

Hypocenomyce scalaris (Acharius) M. Choisy – *Harris 48060, May 451-12.*

Hypogymnia physodes (L.) Acharius – *Flenniken 6181, Harris 47956, Lay 03-0063, Lendemer 1417, May 451-6, Olszewski 5974, Olszewski 5977.*

Imshaugia aleurites (Acharius) S.F. Meyer – *Harris 47957, Lay 03-0064, Lendemer 1375.*

Lecanora albella (Persoon) Acharius var. *rubescens* (Imshaug & Brodo) Lumbsch – *Harris 48061, Lay 03-0066, Lendemer 1388, Lendemer 1641, Olszewski 5975.*

Lecanora pulicaris (Persoon) Acharius – *Harris 48062, Flenniken 7200, Lendemer 1414, Lendemer 1415.*

Lecanora strobilina (Sprengel) Kieffer – *Harris 48063, Lendemer 1399.*

Lecanora symmicta (Acharius) Acharius – *Harris 48064.*

Lecanora thysanophora R.C. Harris – *Buck 45045, Harris 47959, Lendemer 1345, Lendemer 1378, Lendemer 1383, Olszewski 5978.*

Lepraria sp. – *Harris 48065.*

Lepraria lobificans Nylander – *Olszewski 5969.*

Lepraria neglecta (Nylander) Erichsen *s. lat.* – *Harris 47960* (on *Acer rubrum*).

Leptogium cyanescens (Rabenhorst) Körber – *Flenniken 6182.*

Loxospora pustulata (Brodo & Culberson) R. C. Harris – *Olszewski 5966.*

Melanelia subaurifera Nylander – *Flenniken 6183, Flenniken 6184, Harris 47962.*

Micarea melaena (Nylander) Hedlund – *Buck 45052, Harris 47963.*

Micarea neostipitata Coppins & P. May – *Buck 45032.*

Micarea peliocarpa (Anzi) Coppins & R. Santesson – *Lay 03-0071.*

Micarea prasina Fries – *Buck 45041.*

Monodictys lepraria (Berkeley) M.B. Ellis(?)* – *Harris 47960* (killing a thallus of *Lepraria neglecta* s. lat.).

Multiclavula mucida (Fries) R. Petersen – *Buck 44935.*

Mycocalicium subtile (Persoon) Szatala – *Lendemer 1341.*

Myelochroa aurulenta (Tuckerman) Elix & Hale – *Flenniken 6185, Harris 48066.*

Nectriopsis spp.* - *Buck 45050* (on sterile sorediate crust), *Harris 47074* (on *Myelochroa aurulenta*).

Ochrolechia arborea (Kreyer) Almborn – *Harris 48067, Lendemer 1307, Lendemer 1361, Lendemer 1391, Lendemer 1645.*

Ochrolechia pseudopallescens Brodo – *Harris 48068.*

Parmelia squarrosa Hale – *Flenniken 6186, Harris 47965, Lendemer 1416, Olszewski 5963.*

Parmelia sulcata Taylor – *Flenniken 6187, Harris 47966, Lendemer 1308.*

Parmelinopsis spumosa (Asahina) Elix & Hale (?) – *Harris 4967, Lendemer 1376.* There may be more then one taxon currently being called *P. spumosa* in eastern North America. Material from the southern United States differs from northern/central specimens in a number of respects. The collections reported here correspond to the north/central entity. Also there is a possiblility it is not a member of genus *Parmelinopsis.*

Parmotrema chinense (Osbeck) Hale & Ahti – *Olszewski 5961.*

Parmotrema stuppeum (Taylor) Hale – *Harris 48069, Lendemer 1354.*

Pertusaria ophthalmiza (Nylander) Nylander – *Buck 44930.*

Phaeocalicium polyporaeum (Nylander) Tibell – *Buck 44925*

Phaeophyscia rubropulchra (Degelius) Esslinger – *Flenniken 6189..*

Phaeosporobolus spp.* – *Buck 45051* (on *Ochrolechia arborea*), *Harris 47953a* (on *Fuscidea pusilla*).

Physcia millegrana Degelius – *Flenniken 6188, Flenniken 6190, Harris 48070.*

Physcia stellaris (L.) Nylander – *Flenniken 6191.*

Placynthiella sp. – *Buck 45044.*

Placynthiella icmalea (Acharius) Coppins & P. James – *Buck 44927.*

Porpidia albocaerulescens (Wulfen) Hertel & Knoph – *Flenniken 6192.*

Pseudevernia consocians (Vainio) Hale & Culberson – *Harris 47968, Lendemer 1352, Olszewski 5964, Olszewski 5970.*

Punctelia rudecta (Acharius) Krog – *Flenniken 6193, Harris 47969, Lay 03-0086.*

Punctelia subrudecta auct. Amer. – *Harris 48071.*

Rhizocarpon infernulum f. *sylvaticum* Fryday – *Lay 03-0089.*

Rinodina sp. – *Buck 44945.*

Ropalospora chlorantha (Tuckerman) S. Ekman – *Lendemer 1384, Lendemer 1640.*

Trapeliopsis viridescens (Schrader) Coppins & P. James – *Buck 44939, Lay 03-0096.*

Usnea sp. – *Olszewski 5971.*

Usnea hirta (L.) Wigg. – *Olszewski 5965.*

Xanthoparmelia conspersa (Ehrhart *ex* Acharius) Hale – *Flenniken 6194, Flenniken 6195, Flenniken 6196.*

sterile sorediate crustose sp. 1 – *Harris 48072* (atranorin, zeorin, and stictic acid aggregate). This collection resembles *Nadvornikia sorediata* R.C. Harris but differs in larger soralia with smaller soredia and the photobiont is not *Trentepohlia*. The chemistry suggests *Rinodina stictica* Sheard & Tønsberg, however it is much less robust.

sterile sorediate crustose sp. 2 – *Harris 47972* (norstictic acid). This collection represents a sterile sorediate crust seen elsewhere in New England, however no name seems to be available.

3) Litchfield County: Town of Canaan, W of Sand Road, ca. 0.5 mi N of CT 126, ca. 300 m, Lat. 41°, 58', 56"N, Long. 73°, 21', 28"W; rim of old limestone quarry. 21 September 2003.

Acarospora canadensis H. Magnusson(?) – *Harris 46198.*

Agonimia sp. – *Buck 45061.*

Agonimia opuntiella (Buschardt & Poelt) Vèzda – *Buck 45055, Lay 03-0035, Lay 03-0036, Lay 03-0037, Lendemer 1340.*

Amandinea punctata (Hoffmann) Coppins & Scheidegger s. lat. – *Lendemer 1331* (on rock).

Anaptychia palmulata (Michaux) Vainio – *Lendemer 1338.*

Arthonia caesia (Flotow) Körber – *Harris 46173.*

Aspicilia sp. – *Olszewski 5995.*

Bacidia bagliettoana (A. Massalongo & De Notaris) Jatta – *Buck 45073, Lay 03-0041, Lendemer 1646.*

Bacidina egenula (Nylander) Vèzda – *Harris 46176* (saxicolous), *Harris 46202* (on *Placidium*), *Lay 03-0042.*

Botryolepraria lesdainii (Hue) Canals *et al.* – *Buck 42288.*

Caloplaca cerina (Hedwig) Fries – *Harris 46196.*

Caloplaca feracissima H. Magnusson – *Flenniken 7204, Lendemer 1334.*

Caloplaca flavorubescens (Hudson) J.R. Laundon – *Harris 46179.*

Caloplaca flavovirescens (Wulfen) Dalla Torre & Sarnthein *s. lat.* – *Lay 03-0050, Lendemer 1332, Lendemer 1336, May 452-8.*

Caloplaca subsoluta (Nylander) Zahlbruckner – *Buck 42275.*

Candelaria concolor (Dickson) Stein – *Flenniken 7205, Harris 46170, Lay 03-0055, May 452-8, Olszewski 5993.*

Cladonia apodocarpa Robbins – *Flenniken 7206.*

Cladonia chlorophaea (Flörke *ex* Sommerfelt) Sprengel – *May 452-12.*

Cladonia conista Evans – *Harris 48076, Lendemer 1358.*

Cladonia peziziformis (With.) J.R. Laundon – *May 452-1.*

Cladonia pocillum (Acharius) Grognot – *Flenniken 7208, Harris 46195, Lay 03-0052, Lay 03-0053, Lay 03-0054, Lendemer 1357, May 452-11, Olszewski 5986, Olszewski 6000.*

Cladonia ramulosa (With.) J.R. Laundon – *Olszewski 5984, Olszewski 5987.*

Cladonia rei Schaerer – *Flenniken 7209, Lendemer 1648.*

Collema tenax (Swartz) Acharius – *Flenniken 7210.*

Dermatocarpon americanum Vainio – *Buck 42304, Lay 03-0057.*

Endocarpon pusillum Hedwig – *Buck 45070, Harris 46201, Lay 03-0060.*

Endocarpon sp. – *Harris 48077.* This collection consists of tightly overlapping erhizinate (lacking rhizines or rhizohyphae) squamules with a black underside, globose hymenial algae, 2 spores per-ascus; growing over mosses on a limestone boulder in woods.

Flavoparmelia caperata (L.) Hale – Flenniken 7211, Olszewski 5996.

Hyperphyscia syncolla (Nylander) Kalb – *Harris 46178b.*

Lecania naegelii (Hepp) Diederich & v.d. Boom – *Harris 46180a, Lendemer 1412.*

Lecanora dispersa-group(?) – *Harris 46197* (on *Populus*).

Lecanora dispersa (Persoon) Sommerfelt – *Harris 46186, Lendemer 1642(?).*

Lecanora muralis (Schreber) Rabenhorst – *Buck 42314.*

Lecanora polytropa (Hoffmann) Rabenhorst – *Lendemer 1330.*

Leptogium cyanescens (Rabenhorst) Körber – *Lendemer 1325.*

Leptogium dactylinum Tuckerman – *Buck 45066.*

Leptogium lichenoides (L.) Zahlbruckner – *Buck 45072, Lay 03-0068, Lay 03-0069, Lay 03-0070, Lay 03-0099, Olszewski 5985.*

Myxobilimbia sabuletorum (Schreber) Hafellner *in* Hafellner & Türk – *Flenniken 7212, Lay 03-0075, Lay 03-0076, May 452-5, Olszewski 5983.*

Myelochroa aurulenta (Tuckerman) Elix & Hale – *Lendemer 1324.*

Myriospora heppii Hepp – *Harris 46175.*

This species is often cited as *Acarospora heppii* (Hepp) Körber, however, it and the closely related *A. immersa* Fink *ex* Hedrick have an ascus type unlike any species in *Acarospora* s. str.

Myxobilimbia sabuletorum (Schreber) Hafellner – *Buck 42273, Flenniken 7212, Harris 46199, Olszewski 5983.*

Opegrapha rupestris Persoon* – *Buck 42310* (on *Verrucaria* sp.).

Parmelia sulcata Taylor – *Flenniken 7213.*

Peltigera didactyla (With.) J. R. Laundon – *Lendemer 1326.*

Peltigera lepidophora (Vainio) Bitter – *Buck 45068, Flenniken 7214, Harris 48079, Lay 03-0073, May 452-2, Olszewski 5982.*

Peltigera praetextata (Flörke *ex* Sommerfelt) Zopf – *Lay 03-0034, Lendemer 1359, Olszewski 5998.*

Peltigera rufescens (Weiss) Humboldt – *Buck 45071, Flenniken 7215, Harris 46187, Lendemer 1356, May 452-10, Olszewski 5989.*

Phaeocalicium curtisii (Tuckerman) Tibell – *Buck 42291.*

Phaeophyscia adiastola (Esslinger) Esslinger – *Buck 42283, Flenniken 7216, Flenniken 7217, Harris 48080, Lay 03-0078, Lendemer 1429, Olszewski 5988, Olszewski 5999.*

Phaeophyscia ciliata (Hoffmann) Moberg – *Flenniken 7218, Harris 46172, Harris 46178a.*

Phaeophyscia hirtella Esslinger – *Harris 46178.*

Phaeophyscia hispidula (Acharius) Esslinger – *Lendemer 1430.*

Phaeophyscia rubropulchra (Degelius) Esslinger – *Lay 03-0080.*

Phaeophyscia sciastra (Acharius) Moberg – *Flenniken 7219, Lay 03-0079, Lay 03-0165, May 452-7, Olszewski 5991.*

Phaeophyscia squarrosa Kashiwadani – *Lendemer 1337, Lendemer 1339.*

Physcia aipolia (Ehrhart *ex* Humbolt) Fürnrohr – *Flenniken 7220, Olszewski 5997.*

Physcia adscendens Olivier – *Buck 42294, Harris 46171.*

Physcia stellaris (L.) Nylander – *Flenniken 7221, Flenniken 7222, Flenniken 7223, Harris 46180, Harris 46203, Lendemer 1368.*

Physciella chloantha (Acharius) Esslinger – *Olszewski 5990..*

Physconia detersa (Nylander) Poelt – *Flenniken 7224.*

Physconia leucoleiptes (Tuckerman) Esslinger – *Harris 46181.*

Placynthiella icmalea (Acharius) Coppins & P. James – *May 452-3.*

Porpidia crustulata (Acharius) Hertel & Knoph – *Lendemer 1329* (on chert).

Psora decipiens (Hedwig) Hoffmann – *Lay 03-0085.*

Punctelia rudecta (Acharius) Krog – *Flenniken 7225, Lendemer 1346.*

Sarcogyne regularis Körber – *Harris 48081, Lay 03-0090, Lendemer 1333.*

Scutula epiblastematica (Wallroth) Rehm* – *Harris 48084* (on *Peltigera praetextata*).

Staurothele diffractella (Nylander) Tuckerman – *Buck 42284.*

Staurothele drummondii (Tuckerman) Tuckerman – *Buck 45054.*

Thelenella muscorum (Fries) Vainio – *Buck 45053.* This species has previously been assigned to the genus *Chromatochlamys* Trevisan. However, the second author has studied the asci of several collections and found them indistinguishable from those of *Thelenella* Nylander. Since *T. muscorum* is the type of *Chromatochlamys*, the genus is here placed in synonymy with *Thelenella*.

Thelidium zwackhii (Hepp) A. Massalongo – *Harris 46182.*

Thelidium sp. – *Harris 48082, Lendemer 1649.*This collection was found on pebbles, and possesses a strongly areolate, nearly subsquamulose thallus, with 3-septate ascospores, ca. 30µm × 12-14µm.

Trapeliopsis flexuosa (Fries) Coppins & P. James – *Lay 03-0094.*
Verrucaria calkinsiana Servít – *Buck 45057, Harris 48083, Olszewski 6000B.*
Verrucaria nigrescens Persoon – *Olszewski 5994.*
Xanthoparmelia conspersa (Ehrhart *ex* Acharius) Hale – *May 452-9.*
Xanthoparmelia subramigera (Gyelnik) Hale – *Buck 42300.*
Xanthoria ulophyllodes Räsäsnen – *Olszewski 5992.*

4) Litchfield County: Town of North Canaan, Mountain View Cemetery, NW of Sand Road, ca. 300 m, Lat. 42°, 00', 58"N, Long. 73°, 20', 23"W; limestone outcrops on NW corner of cemetery. 20 September 2003.

Anaptychia palmulata (Michaux) Vainio – *Harris 48085, Lendemer 1317.*
Bacidia suffusa (Fries) A. Schneider – *Buck 45087* (on limestone).
Buellia stigmaea Tuckerman – *Harris 48086.*
Caloplaca flavovirescens (Wulfen) Dalla Torre & Sarnthein – *Buck 45089.*
Heterodermia speciosa (Wulfen) Trevisan – *Harris 48088, Lendemer 1313, Lendemer 1314.*
Lecanora strobilina (Sprengel) Kieffer – *Lendemer 1418.*
Lempholemma sp. – *Buck 45088.*This collection is similar to *L. botryosum* (Massalongo) Zahlbruckner but more robust. There is not sufficient comparative material available to make a determination.
Leptogium cyanescens (Rabenhorst) Körber – *Lendemer 1312, Lendemer 1315.*
Lobaria pulmonaria (L.) Hoffmann – *Buck 45084* (on limestone).
Mycocalicium subtile (Persoon) Sazatala – *Lendemer 1318.*
Myxobilimbia sabuletorum (Schreber) Hafellner – *Lendemer 1335.*
Pertusaria globularis (Acharius) Tuckerman – *Lendemer 1310.*
Peltigera lepidophora (Vainio) Bitter – *Lendemer 1316.*
Peltigera neckeri Müller Argoviensis – *Harris 48089, Lendemer 1309.*
Peltigera praetextata (Flörke *ex* Sommerfelt) Zopf – *Harris 48090.*
Pertusaria globularis (Acharius) Tuckerman – *Harris 48091, Lendemer 1310.*
Pertusaria pustulata (Acharius) Duby – *Lendemer 1419.*
Pertusaria velata (Turner) Nylander – *Buck 45085* (on limestone).
Phaeophyscia endococcinoides (Poelt) Esslinger – *Harris 48092, Lendemer 1311.*
Physcia phaea (Tuckerman) J.W. Thomson – *Harris 48093.*
Pyxine sorediata (Acharius) Montagne – *Harris 48094.*
Scutula epiblastematica (Wallroth) Rehm* – *Buck 45076* (on *Peltigera praetextata*).
Xanthoparmelia somlöensis (Gyelnik) Hale – *Harris 48095.*

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Note on the occurence of Nephroma occultumWetm. in Alaska.

Alexei Zavarzin[1] and Einar Timdal[2]

Recent study of lichens kept in the herbarium of Botanical Museum in Oslo, Norway (O) lead to finding of two specimens from Alaska that had previously been identified as "*Nephroma* cf. *parile*". H.Krog collected both specimens in 1957 during fieldwork in Alaska Central Pacific Coast District (see below).

Study of morphological and chemical characters of the specimens allowed to asign them to the endemic to the Pacific Northwest *Nephroma occultum* Wetm., described from canopy branches of douglas fir trees from Oregon in 1980 (Wetmore 1980). Both specimens possess typical characters of *N. occultum*, including cyanobacteria as photobiont, yellowish-greenish-grey colour of *Lobaria scrobiculata*, somewhat broadening lobes with slightly reticulate upper side and soralia as protrusions on the upper surface or along the cracks, as well as hairless, light brownish lower side. Chromatographic investigation confirmed the presence of hopane triterpenoids peltidactylin and zeorin as well as usnic acid.

Since the time of description the species has been reported for the territory of USA and Canada including Oregon (Wetmore 1980), California (Tavares et al. 1996); Washington (McCune, Geiser 1997) and British Columbia (Goward, Ahti 1992; Goward 1995). The only published record of the species in Alaska is one from *Picea sitchensis* at Chilkoot Lake (Geiser et al. 1998). Tor Tønsberg has collected the species near this locality (material in BG, Tønsberg, personal communication). The specimens collected by H.Krog are hence extending the known distribution of the species to about 900 km northwestwards and add new localities to Alaska.

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Specimens examined:

U.S.A., Alaska, Central Pacific Coast District, Kenai Peninsula, Seward. Alt. 0-50 ft. 03.06.1957. Hildur Krog 1593. (O-L 111122)

U.S.A., Alaska, Central Pacific Coast District, Richardson Highway, Mile 9. Alt. 100 ft. 18.08.1957. Hildur Krog 3836. (O-L 111123)

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Evansia to get new Editor

Beginning with Volume 22, (2005) Evansia will have a new Editor.

Larry St. Clair has agreed to take on the editorial duties of the journal and is working closely with the current editor to provide a smooth transition for both authors and subscribers. Some changes will be introduced over the next few issues to improve the format and scientific content of the journal. These changes will be announced as they develop.

Manuscripts can now be sent to Dr. St. Clair at the address below. Authors should review carefully the Guide to Contributors for changes to those instructions and addresses for submission of papers.

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New Records of Rare and Unusual Coastal Lichens from the US Pacific Northwest

**Linda. H. Geiser[1], Doug A. Glavich[1], Alexander G. Mikulin[1],
Anne R. Ingersoll[1] & Martin Hutten[2]**

The hyper-maritime forests of the immediate coast, from San Francisco, California north to the Canadian border with Washington State, provide a unique habitat for unusual epiphytic lichens such as *Byroria pseudocapillaris*, *B. spiralifera*, *B. subcana*, *Erioderma sorediatum*, *Heterodermia leucomela*, *Hypotrachyna revoluta*, *Leioderma sorediatum*, *Leptogium brebissonii*, *Niebla cephalota*, *Pannaria rubiginosa*, *Phyrrospora quernea*, *Pseudocyphellaria perpetua*, *Ramalina pollinaria*, *Teloschistes flavicans*, and *Usnea hesperina*. These particular species are of interest because they are part of the Northwest Forest Plan Survey and Manage program (US Dept. of Agriculture & US Dept. of Interior 2001), a broad based, multi-agency directive that guards biodiversity on federally-managed lands in northern California, and western Oregon and Washington. These species are also of interest because many are rare, some are old-growth associated, and because their future persistence is likely to be by the manner in which publicly-owned lands are managed. It is our objective to provide records of new known sites so that managers, conservationists, and interested lichenologists can know where these species have occurred in the past decade, and retrieve herbarium vouchers if necessary. Absence from the list does not imply absence from an area. Other recent and historical records of these species have been previously summarized by Lesher et al. 2003, McCune et al. 1997, Miadlikowska et al. 2002, Rosentreter (2001), and Glavich 2003. Distribution maps of additional historical sites and the new sites reported below can be found in Glavich et al. 2004.

Methods

The records reported here are from our own field studies and recently accessioned collections in local herbaria (McCune, OSC, WTU). Lichens collected by us were identified using spot tests and morphological characteristics. Secondary chemistry of difficult specimens in the genera *Bryoria*, *Ramalina*, and *Usnea* was confirmed by thin-layer chromatography (White & James 1988).

---

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Results

The following records are located in the Oregon State University herbarium (OSC) unless otherwise noted. Abbreviations: ACEC = Area of Critical Environmental Concern, BLM = Bureau of Land Management, Ck. = Creek, Co. = County, L. = Lake, NRA = National Recreation Area, NWR = National Wildlife Refuge, NF = National Forest, NP = National Park, herb. OLYM = Olympic National Park herbarium, Point = Pt, RNA = Research Natural Area, SP = State Park. The cardinal directions are denoted as n, e, s, and w.

***Bryoria pseudocapillaris* Brodo & D. Hawks.**–CALIFORNIA. Mendocino Co. H.J. Ranch, Point Arena, *Glavich 611*. Humboldt Co. Samoa Peninsula, BLM parcel, *Glavich 523*; Humboldt Bay NWR, Lanphere Dunes, *Glavich 527*; Humboldt Lagoons SP, Dry Lagoon, *Glavich 530*; Little River SP, *Glavich 595*; Patrick's Point SP, *Glavich 503*; Redwood NP, Crescent Overlook, *Glavich 548*; Trinidad Beach SP, *Glavich 534*. Del Norte Co. L. Earl SP, *Glavich 544*. OREGON. Curry Co. Cape Blanco SP, *Glavich 552*; Samuel Boardman SP, Natural Bridges Cove, *Glavich 551*. Coos Co. New River BLM-ACEC, Muddy L., *Mikulin 1227*; Cape Arago SP, *Mikulin 1292*; Oregon Dunes NRA, North Eel Campground vicinity, *Mikulin 1217*. Douglas Co. Umpqua Lighthouse SP, L. Marie, *Geiser 7098*; Oregon Dunes NRA, Takenitch Ck. trail, *Mikulin 1310*. Lane Co. Siuslaw NF, Sutton Ck., *Mikulin 1141*; Heceta Beach *Mikulin 1149*; Oregon Dunes NRA, Goose Pasture, *Mikulin 1152*. Clatsop Co. Saddle Mountain SP, summit, *Mikulin 1180*. Clallam Co. Olympic NP, Sand Point trail, *Mikulin 1291*. WASHINGTON. Island Co. Deception Pass SP, *Mikulin 1260*.

***Bryoria spiralifera* Brodo & D. Hawks.**—CALIFORNIA. Sonoma Co. Stewarts Point Rd., *Riefner 87 – 128* (CANL). Humboldt Co. Samoa Peninsula, BLM parcel, *Glavich 524*; Humboldt Bay NWR, Lanphere Dunes, *Glavich 522*. Del Norte Co. L. Earl SP, *Glavich 590*. OREGON. Coos Co. Siuslaw NF: Bluebill L., *Mikulin 1000*, Spinreel Campground, *Mikulin 1023*; Oregon Dunes NRA, e of Sandpoint L., *Mikulin 1225*. Douglas Co. Umpqua Lighthouse SP, *Mikulin 1012*.

***Bryoria subcana* (Nyl. *ex* Stizenb.) Brodo & D. Hawks.**—OREGON. Coos Co. Oregon Dunes NRA, Eel Ck., *Ingersoll 957*. Linn Co. Willamette NF, Santiam R. watershed, Moose Ck., *Ulrich 970630-1*. Tillamook Co. Siuslaw NF, Cedar L., *Mikulin 1290*. Clatsop Co. Saddle Mountain SP, summit, *Mikulin 1180*.

***Erioderma sorediatum* D. J. Galloway & P. M. Jørg.**—OREGON. Coos Co. Siuslaw NF: Bluebill L., *Mikulin 1002*, Spinreel Campground, *Mikulin 1024*. Lane Co. Siuslaw NF: Sutton Ck., *Mikulin 1130*, Heceta Head vicinity, *Mikulin 1188*, ridge s of Cummins Ck., *Mikulin 1299*. Lincoln Co. Siuslaw NF, Waldport vicinity: Lower Canal Ck., *Geiser 720*, Beaver Ck., *Ingersoll 958*. Tillamook Co. Siuslaw NF, Neskowin vicinity, *Mikulin 1215*. WASHINGTON. Pacific Co. Leadbetter Point SP, *Mikulin 1230*. Jefferson Co. Olympic NP, Hoh River Valley, *Mikulin 1177 & 1283*, *Hutten 7005* (herb. OLYM). Clallam Co. Olympic NP: Ozette L., Allen's Bay, *Hutten 3008* (herb. OLYM), Mora Ranger Station, *Walton 772* (herb. OLYM), James L., *Mikulin 1191*, Point of Arches, *Mikulin 1200*.

***Heterodermia leucomela* (L.) Poelt**—CALIFORNIA. Mendocino Co. Manchester State Beach, *Glavich 538*. Humboldt Co. Trinidad Beach SP, College Cove, *Glavich 535*; Humboldt Lagoons SP, Dry Lagoon, *Glavich 549*; Humboldt Bay NWR, Lanphere Dunes, *Glavich 578*; Samoa Peninsula, BLM parcel, *Glavich 554*; Patrick's Point SP, *Glavich 537*; Redwood NP, Prairie Ck., *Glavich 526*. Del Norte Co. L. Earl SP, *Glavich 529*. OREGON. Curry Co. Cape Blanco SP, *Glavich 575*; Samuel Boardman SP, Natural Bridges Cove, *Glavich 574*; Cape Sebastian SP, *Mikulin 1266*. Douglas Co. Oregon Dunes NRA, 1 km s of Brushy Hill, Reedsport vicinity, *Mikulin 1197*. Coos Co. Cape Arago SP, *Mikulin 1296*. Lane Co. Siuslaw NF: Sutton Ck., *Mikulin 1142*, Heceta Head, *Mikulin 1074*, ~ 4 km e of Devil's Elbow SP, *Mikulin 1189*. Lincoln Co. Yakina Head Natural Area, *Mikulin 1161*. Tillamook Co. Cape Lookout SP, *Mikulin 1117*; Siuslaw NF, 1.6 km n of Cape Kiwanda, *Mikulin 1081*. WASHINGTON. Pacific Co. Fort Canby SP, Cape Disappointment, *Mikulin 1157*.

***Hypotrachyna revoluta* (Flörke) Hale**—CALIFORNIA. Sonoma Co. Pepperwood Ranch Natural Preserve, *McCune 2075* (McCune). OREGON. Tillamook Co. Cape Lookout SP, *Mikulin 1119*; Siuslaw NF: Cascade Head, *Mikulin 1045*, Neskowin vicinity, *Mikulin 1211*; Tillamook State Forest, se of Garibaldi, *Mikulin 1238*; Tillamook Bay at Wilson River mouth, *McCune 26936* (McCune). Clatsop Co. Ecola SP, Tillamook Head, *Mikulin 1089*.

***Leioderma sorediatum* D. J. Galloway & P. M. Jørg.**—OREGON. Douglas Co. Oregon Dunes NRA, 0.3 km sw of s shore of Clearwater L., *Gossen 960619-2*. Lane Co. Siuslaw NF, Sutton Ck., *Mikulin 1133*. Lincoln Co. South Beach SP, *Mikulin 1301*. WASHINGTON. Clallam Co. Olympic NP: James L., *Mikulin 1192*, Point of Arches vicinity, *Mikulin 1201*, Ozette L., *Hutten 3006* (herb. OLYM).

***Leptogium brebissonii* Mont.**—OREGON. Coos Co. Tugman SP, *Mikulin 1058*. Douglas Co. Oregon Dunes NRA, Threemile Ck. vicinity, *Mikulin 1066*; Umpqua Lighthouse SP, *Mikulin 1013*. Lane Co. Siuslaw NF: Sutton Ck., *Mikulin 1143*, Heceta Head, *Mikulin 1075*, ridge above Cummins Ck., *Mikulin 1186*, Ten Mile Ck., *Ingersoll 955*. Lincoln Co. South Beach SP, *Mikulin 1303*; Yakina Head Natural Area, *Mikulin 1164*; Siuslaw NF, ridge above Cedar Ck., *Mikulin 1293*. Tillamook Co. Cape Lookout SP, *Mikulin 1121*; Siuslaw NF: 1.6 km n of Cape Kiwanda, *Mikulin 1083*, Neskowin Crest RNA, 1.3 km se of the mouth of Cliff Ck., *Mikulin 070696-1*, 2.5 km e of Neskowin, *Mikulin 1212*, Sand L. vicinity, *Mikulin 1109*; Tillamook State Forest, se of Garibaldi, *Mikulin 1239*. WASHINGTON. Pacific Co. Fort Canby SP, Cape Disappointment, *Mikulin 1158*; Leadbetter Point SP, Leadbetter s trailhead, *Mikulin 1232*. Grays Harbor Co. Olympic NF, Petes Ck., *Hutten 6198* (herb. OLYM). Jefferson Co. Olympic NP: Hoh Rainforest Campground, Hoh River valley, *Mikulin 1288*, mouth of Hoh River, *Hutten ONP876* (herb. OLYM). Clallam Co. Olympic NP: James L., *Mikulin 1193*, Point of Arches vicinity, *Mikulin 1202*, Rialto Beach, *Mikulin 1168*, Sand Point trail, *Mikulin 1302*, La Push, *Mikulin 1304*, Ozette L., *Hutten 3007* (herb. OLYM).

Niebla cephalota **(Tuck.) Rundel & Bowler**—CALIFORNIA. Mendocino Co. Van Damme SP, *Glavich 569*; Manchester SP, *Glavich 539*; Russian Gulch SP, *Glavich 570*. Humboldt Co. Samoa Peninsula, BLM parcel, *Glavich 525*; Humboldt Bay NWR, Lanphere Dunes, *Glavich 579*; Little River SP, *Glavich 560*; Patrick's Point SP, *Glavich 565*; Redwood NP, Crescent Overlook, *Glavich 594*; Trinidad Beach SP, College Cove, *Glavich 562*; Humboldt Lagoons SP, Dry Lagoon, *Glavich 531*. Del Norte Co. L. Earl SP, *Glavich 589*. OREGON. Curry Co. Cape Blanco SP, estuary of the Sixes River, *McCune 18309* (McCune). Coos Co. Cape Arago SP, *Mikulin 1296*. Lane Co. Siuslaw NF, Sutton Ck., *Mikulin 1147*, Lane Co. Siuslaw NF, 1 km n of Lily L. *Glavich 610*. WASHINGTON. Clallam Co. Sequim Bay SP, *Glew 960803-5* (WTU); 15 km w of Port Angeles, *Hutten 3723* (herb. OLYM). Island Co. Deception Pass SP, *Mikulin 1262*. San Juan Co., Lopez Is., Shark Reef Sanctuary County Park, *Mikulin 1253*; Shaw Is., Hoffman Cove, *Glew 981016-12* (WTU).

Pannaria rubiginosa **(Ach.) Bory**—OREGON. Lane Co. Siuslaw NF, Sutton Ck., *Mikulin 1144*. WASHINGTON. Jefferson Co. Olympic NP, near Kalaloch, *Hutten ONP1142* (herb. OLYM).

Pseudocyphellaria perpetua **McCune & Miadlikowska**— OREGON. Coos Co. Eel Ck., *Miadlikowska 13.08.00* (duke, paratype), *Ingersoll 958*. Douglas Co. Neilson Ck., *Glavich 612*. Lane Co. Siuslaw NF: Gwynn Ck., *McCune 25752* (OSC, holotype), Rock Ck. *McCune 21485* (McCune), Cougar Ck., *Gossen 950707-16*, Nielson Ck., *Lindquist 970724-1*, Five Rivers, *Glavich 613*; Mckenzie R. drainage, Marten Ck., *Anonymous s.n.*, Santiam River drainage: Moose Ck., *Mikulin 1322*; Cascadia SP, *McCune 17393* (McCune). Lincoln Co. Siuslaw National Forest: Williamson Cr, *Gossen 950705-22*, 9 km e of Yachats *Mikulin 1320*, Canal Ck., *Geiser 8000*, Alsea River, *Mikulin 1321*, Beaver Creek, *Ingersoll 962*. Benton Co. Alsea Falls Recreation Site *Berryman 960515-5*. Tillamook Co. Siuslaw NF: 2.5 km e of Neskowin, *Mikulin 1214*, Cascade Head, *Denison 40017*, Hebo Ranger District *Boyll s.n.* WASHINGTON. Pacific Co. Ellsworth Ck., *Tønsberg 33315* (bg). Jefferson Co. Hoh River valley, *Mikulin 1323 & 1324*.

Pyrrhospora quernea **(Dickson) Körber**—CALIFORNIA. Mendocino Co. Jackson State Forest, Mendocino Woodlands Camp, *Ryan 22268* (ASU). Humboldt Co. Little River SP, *Glavich 598*; Redwood NP, Gold Bluff Beach, *Glavich 587*. OREGON. Curry Co. Cape Sebastian SP, *Mikulin 1267*. Coos Co. New River ACEC, Muddy L., *Mikulin 1228*; Cape Arago SP, *Mikulin 1306*; Oregon Dunes NRA: 2 km nw of N Eel Campground, *Mikulin 1220*, 1.6 km s of Sandy Way staging area, *Mikulin 1226*, 6 km n of Bluebill Beach, *Mikulin 1041*; Siuslaw NF, Bluebill L., *Mikulin 1003*; Tugman SP, *Mikulin 1059*. Douglas Co. Oregon Dunes NRA: 1 km wnw of Carter L. Campground, *Mikulin 1209*, 0.3 km s of Brushy Hill, *Mikulin 1199*, s of 3 Mile L., *Mikulin 1068*, 0.75 km w of Takenitch River and Hwy 101 intersection, *Mikulin 1071*; Umpqua Lighthouse SP, *Mikulin 1018*. Lane Co. Siuslaw NF: Sutton Ck., *Mikulin 1145*, 9.5 km s of Cape Perpetua, *Mikulin 1205*; Oregon Dunes NRA, Goose Pasture, *Mikulin 1154*. Lincoln Co. Cascade Head Experimental Forest, *Mikulin 1269*; Yaquina Head Natural Area, *Mikulin 1165*. Clatsop Co. Ecola SP: Indian Point, *Mikulin 1233*, Tillamook Head, *Mikulin 1095*; Fort Stevens SP, *Mikulin 1236*. WASHINGTON. Pacific Co. Fort Canby SP, Cape Disappointment, *Mikulin 1159*. Clallam Co. Olympic NP, Sand Point trail, *Mikulin 1307*; Dept. Natural Resources, 8 km w of Port Angeles, *Mikulin 1196*; Dungeness NWR, *Mikulin 1305*. Jefferson Co. Marrowstone Island, Fort Flagler SP, *Mikulin 1308*. Island Co. Whidbey Is., Deception Pass SP, *Mikulin 1261*. San Juan Co. Orcas Island, Obstruction Pass NRA, *Mikulin 1245*; Lopez Island: BLM Point Colville, *Mikulin 1256*; Shark Reef Sanctuary, *Mikulin 1249*.

Ramalina pollinaria **(Westr.) Ach**—CALIFORNIA. Mendocino Co. Van Damme SP, Fern Canyon, *Glavich 567*; Manchester State Beach, *Glavich 540*. Humboldt Co. Samoa Peninsula, BLM parcel, *Glavich 555* ; Humboldt Bay NWR, Lanphere Dunes, *Glavich 553*; Humboldt Lagoons SP, Dry Lagoon, *Glavich 532*; Little River SP, *Glavich 561*; Patrick's Point SP, Palmer's Point, *Glavich 564*; Trinidad SP: College Cove, *Glavich 563*, Elks Head, *Glavich 536*, Mill Ck., *Glavich 571*. Del Norte Co. L. Earl SP, *Glavich 545*. OREGON. Curry Co. Samuel Boardman SP, Natural Bridges Cove, *Glavich 573*. Coos Co. New River ACEC, Muddy L., *Mikulin 1271*.

Clatsop Co. Ecola SP, Indian Point, *Mikulin 1234*. WASHINGTON. Clallam Co. Dungeness NWR, *Mikulin 1294*.

***Teloschistes flavicans* (Sw.) Norman**— CALIFORNIA. Marin Co. Pt Reyes National Seashore: Mt. Vision, *Glavich 508,* Inverness Ridge, *McCune 25884 (*McCune*)*. OREGON. Curry Co. New River ACEC, *Morgan s.n.* (BLM-Coos Bay herbarium). Tillamook Co., Cape Lookout SP, *Mikulin 1124*, *McCune 17184* (McCune).

***Usnea hesperina* Mot.**—OREGON. Curry Co. Cape Sebastian SP, *Mikulin 1268*. Coos Co. Tugman SP, *Mikulin 1061*. Douglas Co. Oregon Dunes NRA: 0.3 km sw of Clear L., *Gossen 960619-1*, 1 km s of Brushy Hill, *Mikulin 1259*; Siuslaw NF, 11 km e of Siltcoos L. above Fiddle Ck., *Kalt 970530-1*; Umpqua Lighthouse SP, shore of L. Marie, *Geiser 7099*. Lane Co. Siuslaw NF: Heceta Head, *Mikulin 1079*, s of Neptune SP, *Mikulin 1187*, 9.6 km s of Cape Perpetua, *Mikulin 1209*, 1 km e of Herman Peak, *Mikulin 1285*. Tillamook Co. Cape Lookout SP, *Mikulin 1126*; Siuslaw NF: Sand L. vicinity, *Mikulin 1113*, Cascade Head Experimental Forest, *Mikulin 1049*. WASHINGTON. Pacific Co. Fort Canby SP, Cape Disappointment, *Mikulin 1160*; Fort Columbia SP, *Mikulin 1103*. Jefferson Co. Olympic NP, 19 km s of LaPush, Goodman Ck., *Mikulin 1190*. Clallam Co. Olympic NP: James L., *Mikulin 1270*, Mora Campground, *Mikulin 1195*, Point of Arches vicinity, *Mikulin 1203*, Ozette L., *Mikulin 1174*, *Hutten ONP484* (herb. OLYM), *Hutten 2969* (herb. OLYM), L. Mills, *Rome 256* (herb. OLYM); Cape Flattery, *Hutten 1337* (herb. OLYM).

Discussion

Detailed management recommendations for most of these lichens can be found in Lesher et al. 2003. Maintenance or restoration of native habitats and protection from trampling and collection are the most important steps managers can take to conserve these lichens. New finds of these species, especially on public lands, can be reported to the respective state Natural Heritage programs. Locations and habitat information are used by federal biologists during annual species reviews and in revisions of management recommendations. Other rare coastal lichens of interest are *Anaptychia setifera, Bunodophoron melanocarpon, Cladidium bolanderi, Heterodermia japonica, Heterodermia sitchensis, Hypogymnia subphysodes, Hypogymnia pulverata, Pannaria malmei, Usnea nidulans,* and *Usnea rubicunda.* Information that documents rarity, association with old-growth forests, or threats to persistence in the NWFP area such as declining populations, habitat elimination, limited distribution, can be used to consider these species for Survey & Manage listing or status, and to evaluate state rankings within the respective Natural Heritage Programs.

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Fissidens exilis and a key to the species of *Fissidens* in Missouri

Bruce Allen[1], Ronald A. Pursell[2], & Carl Darigo[3]

Fissidens exilis Hedw. (Figs. 1–9) is one of smallest species of *Fissidens* in eastern North America. Its plants range from 1.5 to 2 mm high and have 2–4 pairs of leaves. These minute plants grow from persistent protonemata on bare, usually disturbed soil. The vaginant laminae are unusual in that the smaller one of a pair narrows above with the tip ending at or on the costa, and in having a few irregularly elongated cells intralaminally in most leaves. The species is autoicous and sporophytes are usually abundantly present. These numerous sporophytes, with erect capsules, increase the recognition of these small plants, which otherwise might be passed over.

Hedwig (1801) originally described *F. exilis* from material collected at Endfield Chase, England. The species, possibly introduced from Europe, was unknown in North America until Steere (1950) recognized it in material collected by Maurice B. Walters near Cleveland, Ohio in 1949. Later, Crum & Anderson (1980) reported *F. exilis* from Indiana, Kentucky, Maryland, Michigan, New York, and Pennsylvania. Ronald Pursell recently re-examined the distribution of the species in conjunction with his treatment of *Fissidens* for the *Flora North America* project and found it appears to be spreading throughout eastern North America. *Fissidens exilis* is now also known in the United States from **Alabama** (Colbert Co., *Davison 3610* UNAF), **Illinois** (Cook Co., *Hall 4656* MICH, *Merrill 14260* MO; Jackson Co., *Schuette IL 117/364* and *IL 121/368* MO), **Maine** (Lincoln Co., *Allen 27030* MO), **New Jersey** (Hunterdon Co., *Buck 22181* NY), **North Carolina** (Cleveland Co., *Davison 1623* MO; Durham Co., *Smith 626* MICH; Forsyth Co., *Davison 3134* UNAF; Jackson Co., *Davison 4119* UNAF), **Tennessee** (Knox Co., *Davison 1530* MICH, *3835* UNAF; Montgomery Co., *Davison 4198* UNAF; Sevier Co., *Smith & Davison s.n.* MO, TENN), and **West Virginia** (Pocahontas Co., *Pursell & Davison 12206* MO). In Canada it is known from **Ontario** (Essex Co., *Oldham B-35* MICH, NY) and **Quebec** (Gatineau Co., *J. Ranger s.n.* June 1982).

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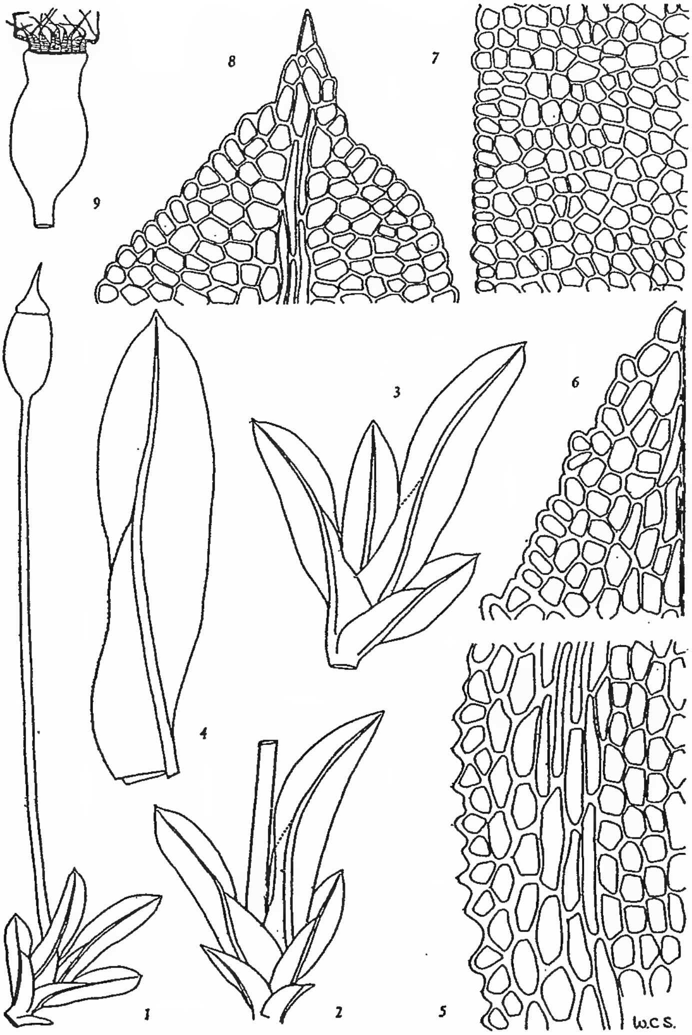

Figures 1–9. *Fissidens exilis* Hedw. 1. Habit of leafy plant bearing sporophyte, x 18. 2–3. Detail of gametophyte plants, x 28. 4. Leaf, x 54. 5. Areolation of margin of vaginant laminae showing intramarginal border, x 350. 6. Cell detail of apex of vaginant lamina at junction with cost, x 350. 7. Cell detail of apical lamina, from margin towards costa, x 350. 8. Cell detail of leaf apex, 350. 9. Detail of capsule showing peristome, x 54. All figures reproducted from The Bryologist 53: 135. 1950.

Gier (1955) reported *F. exilis* from the Missouri Counties of St. Louis and Saline. However, we were unable to locate the collections on which these records are based. The species was collected in St. Louis County, Missouri by William Buck (*Buck 40551* NY) in the autumn (26 October) of 2001. More recently, Nels Holmberg (*Holmberg & Darigo 126* MO) collected *F. exilis* in the early spring (20 March) of 2003 in Queeny Park, St. Louis County. This urban park, which covers 500 acres, includes numerous hiking and equestrian trails that run throughout a secondary growth, mixed hardwood forest. The plants collected by Holmberg were growing on partially shaded, disturbed soil near an equestrian path. The senior author subsequently (29 March 2003) visited this site and found only a few old plants of *F. exilis* remaining, but on a nearby north-facing hillside the species grew in great abundance. These plants (*Allen 24971* MO) were growing especially luxuriantly on mounds of loose earth deposited by earthworms. The current distribution of *F. exilis* in North America is shown in Fig. 10.

Fissidens exilis is an ephemeral moss that appears to be rare. It seems likely, however, that it is a more common species that is rarely collected because of its tiny size and the short time the plants are available for collecting. Certainly in St. Louis County, Missouri, *F. exilis* can be found for a short time in great abundance in both the spring and autumn of the year. There are 13 species of *Fissidens* in Missouri that can be identified using the following key.

Key to the species of *Fissidens* in Missouri

1. Leaves bordered completely or in part by several rows of long, narrow cells .2
1. Leaves unbordered, but marginal cells sometimes lighter in color than inner cells 5
    2. Laminal cells pluripillose .... *F. elegans* (= *F. ravenelii*)
    2. Laminal cells smooth 3
3. Leaf apex rounded to obtuse; leaves ovate to oblong .... *F. obtusifolius*
3. Leaf apex acute, acuminate or obtuse-apiculate; leaves lanceolate oblong-lanceolate or ligulate 4
    4. Laminal cells distinct, not or slightly bulging, in transverse section more or less as wide as deep, (6–)9–13(–16) µm wide .... *F. bryoides*
    4. Laminal cells more or less indistinct, strongly bulging, in transverse section more or less twice as deep as wide, 6.5–10µm long .... *F. minutulus*

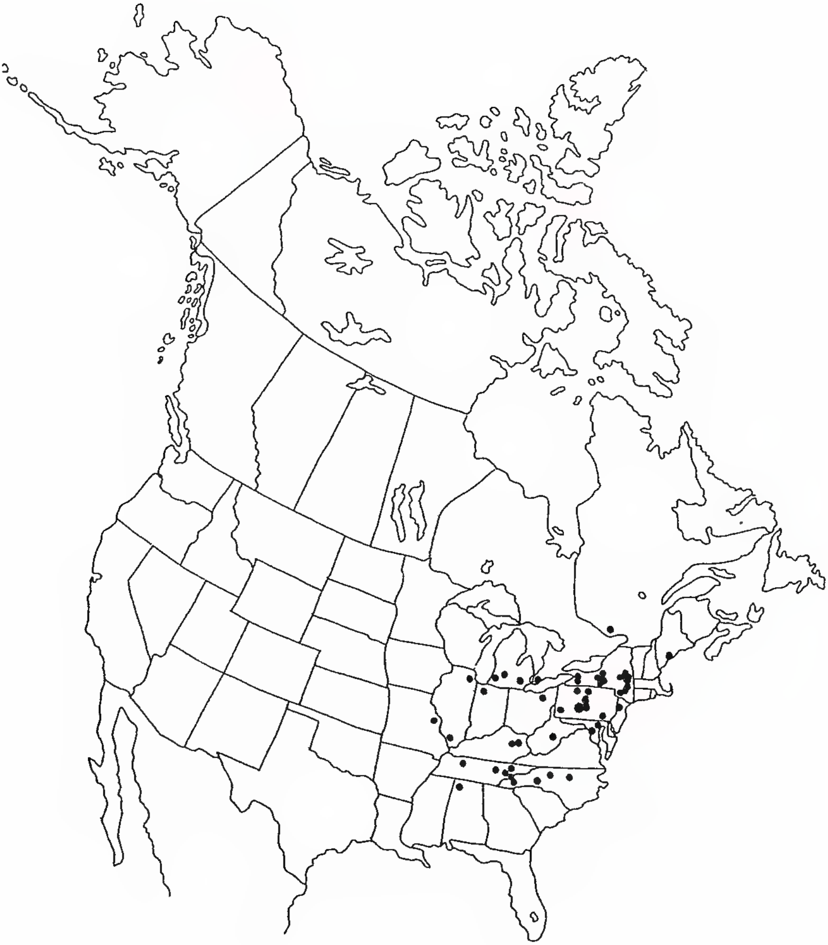

Figure 10. Distribution of *Fissidens exilis* Hedw., in North America.

5. Plants strictly aquatic (submerged in water), sometimes temporarily exposed at low water levels 6
5. Plants terrestrial, saxicolous, or corticolous, sometimes temporarily in water 7
    6. Leaves rigid and coarse; laminal cells in 2 or more layers ....*F. grandifrons*
    6. Leaves soft; laminal cells in one layer .... *F. fontanus*
7. Plants small, 1–2 mm high; vaginant laminae with one or more rows of irregularly elongate intralaminal cells; protonemata persistent . *F. exilis*
7. Plants medium to large, 4–90 mm high; vaginant laminae lacking rows of irregularly elongated intramarginal cells; protonemata not persistent .. 8
    8. Sporophytes (or archegonia) terminal .... *F. osmundioides*
    8. Sporophytes (or archegonia) lateral or basal, or not seen 9
9. Costae ending several cells below leaf apices 10
9. Costae ending in or near cuspidate or apiculate apices 11
    10. Upper parts of the costae obscured by chlorophyllose cells similar in form to the laminal cells .... *F. subbasilaris*
    10. Costae distinct throughout their length .... *F. osmundioides*
11. Leaf apices acute; leaf margins irregularly serrate above, crenulate below 12
11. Leaf apices broadly acute to rounded, sometimes apiculate; leaf margins evenly crenulate, occasionally serrulate at leaf apices 13
    12. Laminal cells 5–9 µm long, irregularly bistratose, bulging ..... *F. dubius*
    12. Laminal cells 10–20 µm long, unistatose, not bulging ... *F. adianthoides*
13. Laminal cells irregularly bistratose; vaginant laminal cells pluripapillose (best seen in transverse section) .... *F. bushii*
13. Laminal cells unistratose, vaginant laminal cells each with a blunt, conic mammilla .... *F. taxifolius*

Acknowledgement. We thank the Curator of CANM for the loan of the Quebec *Fissidens exilis* collection.

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Gier, L. J. 1955. Missouri Bryophytes. Transactions of the Kansas Academy of Sciences. 58: 24–49.

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Brachythecium campestre (Musci: Brachytheciaceae) New to Missouri

Carl E. Darigo[1]

At the request of the St. Louis County Parks Department, the Webster Groves Nature Study Society's Botany Group has been conducting a herbaceous plant survey at Rock Hollow Park, a newly opened facility along the north side of the Meramec River, near Glencoe, in the western part of the county. The area contains some upland oak-hickory forest and glades, but primarily is a rich, moist, bottomland hollow which runs north from the river.

During the 3rd visit on 1 April 2004, the Group's leader, Father James Sullivan, asked the author to examine a small piece of moss. Initially the plants appeared to be a robust expression of the common *Brachythecium laetum* (Brid.) B.S.G. and were about to be discarded, when a sporophyte was seen. Since *B. lateum* is dioicous and rarely has sporophytes, additional material was collected for microscopic examination, which revealed the plants to be ***Brachythecium campestre*** (C. Müll.) Schimp. *in* B.S.G., new to Missouri.

The plants, with abundant sporophytes, were growing in a healthy, six inch diameter patch, on partially shaded, moist, sandy soil, between an old forest road and minature railroad tracks, at 425 feet elevation, several hundred yards from the river. Mixed associated species were *Plagiomnium cuspidatum* (Hedw.) T. Kop. and *Taxiphyllum taxirameum* (Mitt.) Fleisch.

Brachythecium campestre (C. Müll.) Schimp. *in* B.S.G. St. Louis County, Missouri, 1 April 2004, Darigo & Sullivan 4026 (MO). Setae 10-15 mm long, slightly roughened entire length, capsules inclined, 2 mm long, spores 15-18µm, lightly papillose, plants autoicous, branch leaves erect-spreading, 2 mm long, acuminate, plicate, serrulate from apex almost to base, somewhat decurrent, slightly falcate, with numerous quadrate alar cells, not enlarged or inflated, and costa 2/3 length of leaf.

The species has been reported by Crum & Anderson (1981) from New England to Minnesota, south to Iowa, Michigan, Pennsylvania and New Jersey. Collections are in MO from numerous eastern states, plus Arkansas, Illinois, South Dakota and Utah, so finding the species in Missouri is not surprising.

Acknowledgments Thank to Bruce Allen for confirming the determination and Father James Sullivan for initially drawing attention to the plants.

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Crum, H. A. & L. E. Anderson. 1981. Mosses of Eastern North America. Vol. 2. Columbia University Press, New York.

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Fissidens ex~~c~~ilis in Illinois

Scott Schuette

Once considered a rare occurrence, *Fissidens ex~~c~~ilis* is now widespread throughout the eastern United States (R. Pursell pers. comm.). Crum and Anderson (1981) report this species from Indiana, Kentucky and Missouri but not Illinois. McKnight (1987) published the most recent checklist of mosses with the Illinois Natural History Survey that did not list *F. excilis* as occurring in Illinois.

Recent excursions to collect some spring ephemeral mosses, *F. excilis* was discovered growing at two locations in Jackson County along Campus Lake at Southern Illinois University, Carbondale. *Fissidens ex~~c~~ilis* has also been collected in the Cook County Forest Preserve District in northern Illinois (R. Pursell pers. comm.).

Original collections of *F. ex~~c~~ilis* are located in two herbaria, Field Museum (F)[1], Southern Illinois University (SIU)[2,3] with duplicates in Pennsylvania State University (PAC).

1) Cook Co.: Swallow Cliff, Cook County Forest Preserve District, 41°40.5'N, 87°51.8'W, elev. 215 m. On soil along edge of small gulley in open oak woodland. Leg.: G. Merrill 14260 15 May 1997.
2) Jackson Co.: Campus Lake, Southern Illinois University, 37°42.515'N, 89°13.840'W, elev. 144 m. On soil near parallel bars along trail on south side of lake. Leg. S. Schuette IL117/364 16 March 2003.
3) Jackson Co.: Campus Lake, Southern Illinois University, 37°42.402'N, 89°13.444'W, elev. 154 m. On soil along drainage crevice in a stand of white pine on southeast side of lake. Leg. S. Schuette IL121/368 3 April 2003.

Acknowledgements. Many thanks to Ron Pursell and Dale Vitt for assisting with the species verification for the Jackson Co. collections. Much appreciation to Ron Pursell for sharing the information on the Cook Co. collection.

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McKnight, B.N. 1987. The bryophytes of Illinois: an annotated and indexed bibliography and checklist. Illinois Natural History Survey, Urbana, Illinois, Biological Notes No. 127.

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A Checklist of the Lichens Collected During the Tuckerman Workshop #12, Outer Banks, North Carolina, USA

James C. Lendemer[1] & Rebecca Yahr[2]

Abstract. *A checklist of the lichens collected during the 12th Tuckerman Workshop in Outer Banks, North Carolina, USA is provided.*

Between March 17, 2003 and March 21, 2003 the participants of Tuckerman Workshop #12 collected in a variety of habitats near the Outer Banks of North Carolina, USA.

It should be noted that the identifications presented here are those of the collectors, thus all collections were not identified or confirmed by any single individual. Likewise, because the group as a whole collected together at all locations "*et al.*" is not included after each collection but is implied. In some cases nomenclature does not follow standard lists (Esslinger, 1997) but instead reflects the preferences of the determiners. Authorities for most taxa are given in full and some differ slightly from those of the *North American Checklist* (Esslinger, 1997). A list of the participants (who provided lists of their collections) is provided below with the herbaria in which their collections are deposited: W.R. Buck (NY), J.C. Crane (ILLS), B. Egan (OMU), D. Flenniken (hb. Flenniken), R.C. Harris (NY), S. LaGreca (FH, and hb. LaGreca), E. Lay (hb. Lay), J.C. Lendemer (hb. Lendemer), P. May (hb. May), R. Yahr (DUKE).

1) North Carolina. Jones County: Croatan National Forest, Croatan Game Land W of Mattocks Road, 2.1 mi N of Mire Branch Road, 34°55'08"N, 77°10'40"W; pocosin dominated by *Gordonia lasianthus*, *Persea borbonia* and *Magnolia virginiana*. 17 March 2003.

Bacidia heterochroa (Müll. Arg.) Zahlbruckner – *LaGreca 930.*
Buellia elizae (Tuckerman) Tuckerman – *Buck 43702.*
Buellia stillingiana Steiner – *Lay 03-0175.*

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Bulbothrix confoederata (Culberson) Hale – *Egan 15947, Flenniken 6050, LaGreca 934, Lendemer 735.*

Bulbothrix goebelii (Zenker) Hale – *Egan 15953, Egan 15941.*

Byssoloma leucoblepharum (Nylander) Vainio – *Buck 43685, LaGreca 936, Lay 03-0179, Lay 03-0180, Lendemer 714.*

Byssoloma meadii (Tuckerman) Ekman – *Buck 43689, Buck 43706, Crane 03-2, Lay 03-0183, Lendemer 705, Lendemer 718, Yahr 4625.*

Byssoloma subdiscordans (Nylander) P. James – *Lay 03-0184, Yahr 4624.*

Canoparmelia amabilis Heiman & Elix – *Flenniken 6051.*

Canoparmelia caroliniana (Nylander) Elix & Hale – *Egan 15952, Egan 15942, Flenniken 6052, Lay 03-0185.*

Cladonia subradiata (Vainio) Sandstede – *Flenniken 6035.*

Coenogonium lutea (Dickson) Kalb & Lücking – *Lay 03-0195, Yahr 4623.*

Graphis lineola auct. – *Buck 43687.*

Graphis scripta (L.) Acharius – *Flenniken 6135.*

Gyalideopsis spp. – *Buck 43690, Buck 43692, Buck 43694, Buck 43695, Buck 43699, Buck 43704, Buck 43705, LaGreca 929, LaGreca 932, Lay 03-0202.*

Haematomma accolens (Stirton) Hillmann – *Crane 03-1, Flenniken 6054, Lendemer 1097.*

Heterodermia obscurata (Nylander) Trevisan – *Flenniken 6055.*

Heterodermia speciosa (Wulfen) Trevisan – *Flenniken 6056.*

Hypotrachyna livida (Taylor) Hale – *Flenniken 6057, Lay 03-0205.*

Hypotrachyna osseoalba (Vainio) Park & Hale – *Flenniken 6058.*

Lecanora caesiorubella Acharius – *Flenniken 6059.*

Lecanora hybocarpa (Tuckerman) Brodo – *Crane 03-5, Flenniken 6136.*

Leptogium cyanescens (Rabenhorst) Körber – *Flenniken 6060.*

Maronea polyphaea H. Magnusson – *Buck 43693, Lay 03-0212, Lay 03-0215.*

Micarea prasina Fries – *Buck 43688, Buck 43691.*

Ochrolechia africana Vainio – *LaGreca 931.*

Opegrapha varia Persoon – *Flenniken 6137.*

Parmelinopsis horrescens (Taylor) Elix & Hale – *Flenniken 6061.*

Parmelinopsis spumosa (Asahina) Elix & Hale – *Egan 15945, Egan 15955.*

Parmotrema crinitum (Acharius) Choisy – *Flenniken 6063p.p.*

Parmotrema perforatum (Jacquin) A. Massalongo – *Flenniken 6062.*

Parmotrema rampoddense (Nylander) Hale – *Flenniken 6063p.p., Flenniken 6064.*

Parmotrema submarginale (Michaux) DePriest & B. Hale – *Flenniken 6065.*

Phaeographis dendritica (Acharius) Müll. Arg. – *Yahr 4260.*

Physcia americana G. Merrill – *Lay 03-0013.*

Piccolia conspersa (Fée) Hafellner (?) – *Buck 43696.*

Punctelia rudecta (Acharius) Krog – *Crane 03-4, Flenniken 6063p.p., Flenniken 6066.*

Pyrrhospora varians (Acharius) R.C. Harris – *Buck 43700, Buck 43707.*

Pyrrhospora varians is well known as an orphaned taxon that after being rejected from *Lecidea* Acharius and placed in *Pyrrhospora* Körber, was rejected from *Pyrrhospora.* Though Hertel (2004) treats *P. varians* as a species of *Lecidea s. lat.,* we retain it in *Pyrrhospora* here.

Ramalina paludosa Moore – *Flenniken 6067.*

Rimelia cetrata (Acharius) Hale & Fletcher – *Flenniken 6068, Flenniken 6069.*

Rimelia reticulata (Taylor) Hale & Fletcher – *Egan 15954, Flenniken 6070.*

Usnea evansii Motyka – *Flenniken 6071.*

It should be noted that the name *U. evansii* Motyka should be restricted to primarily coastal specimens from the southeastern USA which contain galbinic acid in addition to usnic and nortstictic acids and agree morphologically with the suite of characters given by Tavares (1987) but have a white/pinkish medulla. The presence of galbinic acid, inflated fibrils, foveate branches, and a white medulla suggest that perhaps *U. evansii* should be rejected from the *U. strigosa*-species aggregate and instead placed with morpholgically and chemically similar taxa such as *U. dasaea* Stirton.

Usnea mutabilis Stirton – *Egan 15956.*

Usnea strigosa (Acharius) Eaton – *Flenniken 6072.*

2) North Carolina. Jones County: Croatan National Forest, Catfish Lake South Wilderness, E of Mattocks Road, 0.4 mi N of Mire Branch Road, 34°54’05”N, 77°10’39”W; pocosin dominated by *Pinus serotina* and *Acer rubrum.* 17 March 2003.

Amandinea punctata (Hoffmann) Coppins & Schneider – *Buck 43708.*

Arthonia sp. – *Lendemer 1667.*

Arthonia albrovirescens Nylander – *Buck 43715.*

Arthothelium interveniens (Nylander) Zahlbruckner - *LaGreca 940.*

Bacidia schweinitzii (Fries *ex* Michener *in* Darlington) Schneider – *Egan 15962, LaGreca 937.*

Buellia curtisii (Tuckerman) Imshaug – *Lay 03-0171.*

Buellia stillingiana J. Steiner – *Lay 03-0176, Lendemer 749.*

Byssoloma leucoblepharum (Nylander) Vainio – *Lay 03-0181.*

Byssoloma meadii (Tuckerman) Eckman – *Lendemer 705.*

Canoparmelia caroliniana (Nylander) Elix & Hale – *Egan 15969, Lay 03-0186, Lendemer 1821.*

Cladonia coniocraea (Flörke) Sprengel – *Egan 15964.*

Cladonia incrassata Flörke – *Yahr 4636, Yahr 4647.*

Cladonia ochrochlora Flörke – *Yahr 4645.*

Cladonia santensis Tuckerman – *Yahr 4644.*

Cladonia subradiata (Vainio) Sandstede – *Yahr 4646.*

Collema pulchellum Acharius – *LaGreca 938.*

Gyalideopsis spp. – *Buck 43717, Buck 43719,*

Heterodermia albicans (Persoon) Swinscow & Krog – *Yahr 4628.*

Heterodermia obscurata (Nylander) Trevisan – *Lay 03-0204.*

Hypotracyna livida (Taylor) Hale – *Egan 15971.*

Lecanora hybocarpa (Tuckerman) Brodo – *Lay 03-0208,Lay 03-0209, Yahr 4634.*

Leptogium cyanescens (Rabenhorst) Körber – *Buck 43721.*

Maronea polyphaea H. Magnusson – *Lendemer 1670.*

Micarea sp. – *Lendemer 1669.*

Micarea prasina Fries – *Buck 43717, Buck 43720.*

Mycocalicium subtile (Persoon) Szatala – *Buck 43716.*

Ochrolechia africana Vainio – *Buck 43718.*

Parmelinopsis horrescens (Taylor) Elix & Hale – *Egan 15959.*

Parmotrema mellissii (Dodge) Hale – *Egan 15957. Egan 15970a.*

Parmotrema perforatum (Jacquin) A. Massalongo – *Egan 15967, Egan 15975.*

Parmotrema submarginale (Michaux) DePriest & B. Hale – *Lay 03-0219.*

Pertusaria xanthodes Müll. Arg. – *Buck 43709.*

Phaeographis inusta (Acharius) Müll. Arg. – *Lay 03-0222.*

Phlyctis ludoviciensis (Müll. Arg.) *ined.* – *Buck 43712, Yahr 4630.*

Placynthiella icmalea (Acharius) Coppins & James – *Buck 43722.*

Punctelia rudecta (Acharius) Krog – *Egan 15968, Egan 15963.*

Pyrenula pseudobufonia (Rehm) R.C. Harris – *Lendemer 755.*

Pyrrhospora russula (Acharius) Hafellner – *Lendemer 719.*

Pyrrhospora varians (Acharius) R.C. Harris – *Yahr 4633, Lay 03-0229, Lendemer 1668.*

Ramalina willeyi Howe – *Lendemer 736.*

Ramonia microspora Vézda – *Buck 43723.*

Rimelia reticulata (Taylor) Hale & Fletcher – *Egan 15970, Egan 15958, Lay 03-0230, Lendemer 1095.*

Sarcographa tricosa (Acharius) Müll. Arg. – *Lay 03-0231.*

Trypethelium virens Tuckerman *ex* Michener *in* Darlington – *Buck 43710, Egan 15972.*

Usnea mutabilis Stirton – *Egan 15960.*

3) North Carolina. Jones County: Croatan National Forest, Island Creek Walk, N of NC Bike 3 (Island Creek Road), 35°01'39"N, 77°08'11"W; *Fagus-Carpinus-Taxodium* forest with marl outcrops along Island Creek. 17 March 2003.

Agonimia sp. – *Lendemer 754.*
Anisomeridium biforme (Borrer) R.C. Harris – *Lay 03-0166.*
Arthonia rubella (Fée) Nylander – *Yahr 4656.*
Bacidia schweinitzii (Fries *ex* Michener *in* Darlington) G. Schneider – *Lay 03-0169.*
Bacidina egenula (Nylander) Vézda – *Buck 43733, Lay 03-0170.*
Bathelium carolinianum (Tuckerman) R.C. Harris - *LaGreca 947, Yahr 4657.*
Buellia curtisii (Tuckerman) Imshaug – *Buck 43732.*
Bulbothrix isidiza (Nylander) Hale – *Flenniken 6073.*
Byssoloma leucoblepharum (Nylander) Vainio – *Buck 43734, Lay 03-0182.*
Canomaculina haitiensis (Hale) Elix - *Egan 15980.*
Cladonia santensis Tuckerman – *Lendemer 800.*
Collema subflaccidum Degelius – *Crane 03-8, Egan 15983, Lay 03-0194, Lendemer 1820.*
Dimerella lutea (Dickson) Trevisan – *Yahr 4651.*
Endocarpon pusillum Hedwig – *Buck 43736, Crane 03-12, Lendemer 698*
Fissurina insidiosa Knight & Mitten – *Buck 43725, Buck 43739, Lay 03-0199.*
Gomphillus americanus Esslinger – *Buck 43747.*
Hypotrachyna livida (Taylor) Hale – *Flenniken 6074, LaGreca 946.*
Leptogium austroamericanum (Malme) Dodge - *LaGreca 950.*
Leptogium cyanescens (Rabenhorst) Körber – *Egan 15988, Flenniken 6075, Lay 03-0211, Lendemer 1819, Yahr 4653.*
Leptogium dactylinum Tuckerman – *Yahr 4659.*
Lobaria ravenelii (Tuckerman) Yoshimura – *Egan 15973.*
Myriotrema glaucescens (Nylander) Hale – *Buck 43740, Lay 03-0016.*
Myriotrema wightii (Taylor) Hale – *Egan 15976, Lendemer 694*
Opegrapha varia Persoon – *Yahr 4650.*
Opegrapha vulgata Acharius – *Buck 43737.*
Parmotrema perforatum (Jacquin) A. Massalongo – *Crane 03-7, Egan 15974, LaGreca 914.*
Parmotrema rampoddense (Nylander) Hale – *Egan 15982.*
Parmotrema rigidum (Lynge) Hale – *LaGreca 945.*
Parmotrema submarginale (Michaux) DePriest & B. Hale – *Egan 15986.*

Pertusaria paratuberculifera Dibben – *Lendemer 797.*
Pertusaria subpertusa Brodo – *LaGreca 943.*
Phaeophyscia rubropulchra (Degelius) Esslinger – *Crane 03-11.*
Phaeophyscia squarrosa Kashiwadani – *Flenniken 6076.*
Phyllopsora parvifolia (Persoon) Müll. Arg. – *Buck 43743.*
Porina sp. – *LaGreca 948.*
Porina heterospora (Fink *ex* Hedrick) R.C. Harris – *Crane 03-9, Lay 03-0223, Lendemer 799, Yahr 4654.*
Punctelia rudecta (Acharius) Krog – *Egan 15979.*
Pyrenula cruenta (Montagne) Vainio – *Buck 43729, Lendemer 737.*
Pyrenula leucostoma Acharius – *Buck 43728, Crane 03-6, Lay 03-0225, Lendemer 2429, Yahr 4652.*
Pyrenula pseudobufonia (Rehm) R.C. Harris – *Lendemer 743.*
Pyrenula santensis (Nylander) Müll. Arg. – *Buck 43726.*
Pyrenula ravenellii (Tuckerman) R.C. Harris – *Egan 15984, Lendemer 696.*
Rimelia reticulata (Taylor) Hale & Fletcher – *Egan 15978, Egan 15978a.*
Rimelia subisidiosa (Müll. Arg.) Hale & Fletcher – *Egan 15981.*
Sticta carolinensis McDonald *in* McDonald *et al.* – *Egan 15987, Lendemer 695, Lendemer 756.*
Thelidium zwackhii (Hepp) A. Massalongo – *Buck 43742.*
Thelotrema subtile Tuckerman – *Buck 43724, Lendemer 923.*
Trypethelium tropicum (Acharius) Müll. Arg. – *Lendemer 744.*
Usnea sp. – *Flenniken 6079.*
Usnea ceratina Acharius – *Crane 03-10.*
Usnea evansii Motyka – *Flenniken 6077.*
Usnea mutabilis Stirton – *Egan 15985.*
Usnea pensylvanica Motyka – *Lendemer 1818.*
Usnea strigosa (Acharius) Eaton – *Crane 03-22, Flenniken 6078.*
Verrucaria baldensis Massalongo *s. lat.* – *Lendemer 697.*

4) North Carolina. Pender County: Holly Shelter Game Land, just E of Shaw Highway (SR 1523) at Lodge Road, 5.3 mi S of NC 53, 34°33'07"N, 77°48'41"W; *Pinus palustris-Quercus laevis* dominated sand scrub. 18 March 2003.

Agonimia sp. – *Buck 43776.*
Arthonia sp. – *Buck 43771.*
Arthothelium taediosum auct. amer. – *Buck 43767.*
Bactrospora mesospora R.C. Harris – *Buck 43765.*

Buellia curtisii (Tuckerman) Imshaug – *Buck 43752, LaGreca 952, Lay 03-0172, Lay 03-0173.*
Buellia imshaugiana R.C. Harris – *Egan 16004, Lay 03-0174.*
Buellia stillingiana Steiner – *Lay 03-0177, Lay 03-0178.*
Bulbothrix confoederata (Culberson) Hale – *Flenniken 6080.*
Bulbothrix isidiza (Nylander) Hale – *Flenniken 6081, Flenniken 6082.*
Calicium abietinum Persoon – *Buck 43769.*
Calicium spp. – *Buck 43751, Buck 43772.*
Caloplaca chryophthalma Degelius – *Lay 03-0022.*
Canomaculina subtinctoria (Zahlbruckner) Elix – *Flenniken 6083.*
Canoparmelia caroliniana (Nylander) Elix & Hale – *Egan 16011, Egan 16003, Egan 16033, Flenniken 6084, Flenniken 6085.*
Chaenothecopsis sp. – *Buck 43759.*
Chaenothecopsis debilis (Turner & Borrer *ex* Smith & Sowerby) Tibell – *Crane 03-37, Lay 03-0006.*
Chrysothrix candelaris (L.) J.R. Laundon – *Egan 16025, Lay 03-0192.*
Cladina evansii (Abbayes) Hale & W.L. Culberson – *Crane 03-27, Flenniken 6086, Flenniken 6087, Flenniken 6088.*
Cladina subtenuis (Abbayes) Hale & W.L. Culberson – *Egan 15992, Egan 16023, LaGreca 953, Lay 03-0187.*
Cladonia apodocarpa Robbins – *Yahr 4668.*
Cladonia chlorophaea (Flörke *ex* Sommerfelt) Sprengel – *Crane 03-26.*
Cladonia cryptochlorophaea Asahina – *Flenniken 6089.*
Cladonia caroliniana Schweinitz *ex* Tuckerman (= *C. dimorphoclada* auct.) – *Yahr 4662, Yahr 4664.*
Cladonia cristatella Tuckerman – *Yahr 4689.*
Cladonia dimorphoclada Robbins – *Lendemer 669.*
Cladonia fimbriata (L.) Fries – *Flenniken 6090.*
Cladonia floridana Vainio – *Yahr 4669.*
Cladonia leporina Fries – *Crane 03-32, Egan 15993, Flenniken 6091, LaGreca 955, Lay 03-0188, Lendemer 681.*
Cladonia macilenta Hoffmann – *Yahr 4686.*
Cladonia pachycladodes Vainio – *Lay 03-0189, Lendemer 672, Yahr 4660, Yahr 4663.*
Cladonia rappii A. Evans – *Egan 16002, Lay 03-0190, Lendemer 671, Yahr 4665.*
Cladonia sobolescens Vainio – *Yahr 4679.*
Cladonia subradiata (Vainio) Sandstede – *Flenniken 6092.*
Cladonia subsetacea A. Evans – *Yahr 4661.*
Cladonia symphicarpia (Flörke) Fries – *Flenniken 6093.*

Cladonia uncialis (L.) Wigg. – *Egan 15991, Egan 16008, Flenniken 6094, Lay 03-0191.*

Coccocarpia erythroxyli (Sprengel) Swinscow & Krog – *Egan 16026.*

Coccocarpia palmicola (Sprengel) Arvidsson & Galloway – *Lay 03-0193, Lendemer 686.*

Coenogonium sp. – *Buck 43766.*

Dirinaria confusa Awasthi – *Lay 03-0196.*

Endocarpon pusillum Hedwig – *Lay 03-0197.*

Graphis lucifica R.C. Harris – *Yahr 4677.*

Gyalideopsis spp. – *Buck 43755, Buck 43762, Buck 43775, Buck 43779, Buck 43786, Crane 03-31, Lendemer 676, Lendemer 677, Lendemer 678, Lendemer 679, Lendemer 758, Lendemer 759, Lendemer 760.*

Haematomma accolens (Stirton) Hillmann – *Lendemer 1096.*

Heppia adglutinata (Kremplehuber) A. Massalongo – *Buck 43777, Crane 03-35, Egan 16037, Lay 03-0203, Lendemer 685, Yahr 9680.*

Hypotrachyna osseoalba (Vainio) Hale & Park – *Egan 16012.*

Lecanora cupressi Tuckerman - *LaGreca 956.*

Lecanora louisianae Bains de Lesdain – *Buck 43781.*

Lecanora subpallens Zahlbruckner – *Buck 43780.*

The use of *L. subpallens* here follows that of Lendemer (2004a) as the name for *L. caesiorubella* ssp. *prolifera* (Fink *ex* Hedrick) R.C. Harris at the species level.

Loxospora pustulata (Brodo & W.L. Culberson) R.C. Harris – *Lendemer 688, Lendemer 757.*

Maronea polyphaea H. Magnusson – *Buck 43758, Lay 03-0214.*

Micarea misella (Nylander) Hedlund (?) – *Buck 43764.*

Ochrolechia africana Vainio – *Flenniken 6134, Lay 03-0216, Lendemer 675, Yahr 4675.*

Parmelinopsis horrescens (Taylor) Elix & Hale - *Flenniken 6095, LaGreca 954, Lay 03-0218.*

Parmeliopsis subambigua (Gyelnik) Gyelnik – *Egan 16024, Flenniken 6096, LaGreca 951, Lay 03-0217, Lendemer 680.*

Parmotrema hypoleucinum (Steiner) Hale – *Egan 16000, Egan 16014.*

Parmotrema hypotropum (Nylander) Hale – *Flenniken 6097.*

Parmotrema madagascariaceum (Hue) Hale – *Egan 15996.*

Parmotrema perforatum (Jacquin) A. Massalongo – *Crane 03-23, Egan 16030.*

Parmotrema rampoddense (Nylander) Hale – *Egan 16028, Egan 16007, Egan 15989, Egan 16032, Lendemer 690, Lendemer 691.*

Parmotrema rigidum (Lynge) Hale – *Egan 16030a.*

Parmotrema submarginale (Michaux) DePriest & B. Hale – *Egan 16031, Egan 16006, Egan 16013.*

Parmotrema tinctorum (Delise *ex* Nylander) Hale – *Egan 15998, Egan 15994, Lendemer 693.*

Parmotrema ultralucens (Krog) Hale – *Egan 16018, Egan 15997a, Egan 16035.*

Parmotrema xanthinum (Müll. Arg.) Hale – *Egan 16005, Egan 16015, Flenniken 6098, LaGreca 957, Lendemer 692.*

Pertusaria epixantha R.C. Harris – *Buck 43774, Lendemer 926.*

Pertusaria neoscotica Lamb – *Buck 43749, Lendemer 925.*

Phaeographis dendritica (Acharius) Müll. Arg. – *Yahr 4673.*

Placynthiella sp. – *Lendemer 1056.*

Placynthiella uliginosa (Schrader) Coppins & P. James – *Yahr 4681.*

Piccolia conspersa (Fée) Hafellner (?) – *Buck 43754.*

Punctelia rudecta (Acharius) Krog – *Egan 16019, Egan 16020, Egan 16034.*

Pycnothelia papillaria Dufour – *Buck 43768, Crane 03-24, Yahr 4678.*

Pyrrhospora russula (Acharius) Hafellner – *Buck 43783, LaGreca 941, Lay 03-0226, Yahr 4676.*

Pyrrhospora varians (Acharius) R.C. Harris – *Lay 03-0228.*

Ramonia microspora Vézda – *Buck 43757.*

Rimelia reticulata (Taylor) Hale & Fletcher – *Egan 16018a, Egan 15997, Egan 16036.*

Rimelia subisidiosa (Müll. Arg.) Hale & Fletcher – *Flenniken 6099, Lendemer 687.*

Trapeliopsis flexuosa (Fries) Coppins & P. James – *Lendemer 03-0235.*

Trapeliopsis granulosa (Hoffmann) Lumbsch – *Yahr 4670.*

Usnea sp. – *Flenniken 6104.*

Usnea baileyi (Stirton) Zahlbruckner – *Lendemer 1091.*

Usnea mutabilis Stirton – *Crane 03-36, Egan 16016a, Lendemer 1092, Yahr 4683.*

Usnea pensylvanica Motyka – *Egan 16001, Egan 16016b, Flenniken 6101, Lendemer 727, Lendemer 728, Lendemer 729, Yahr 4682.*

Though considered a synonym of *U. rubicunda* Stirton by Ohmura (2001) this name has been reinstated by Lendemer (2004) and widely distributed in an exsiccat (*Lich. East. N. Amer. Exs. II: 86*). The exact limits of its distribution in North America remain undetermined as does its relationship to *U. rubicunda* Stirton in the sense of the type and other, superfically similar species in east and southeast Asia. A revision of *U. pensylvanica* in eastern North America in currently in preparation (Lendemer in prep.).

Usnea strigosa (Acharius) Eaton – *Egan 16029, Flenniken 6102, Lay 03-0236, Yahr 4684.*

Usnea subscabrosa Nylander *ex* Motyka – *Crane 03-30, Egan 16016, Flenniken 6103, Yahr 4685.*
Usnea trichodea Acharius – *Lendemer 689.*
Verrucaria calciseda DC – *Lay 03-0237.*

5) North Carolina. Pender County: Holly Shelter Game Land, along Lodge Road, 1.2 mi E of Shaw Highway (SR 1523), 5.3 mi S of NC 53, 34°33'07"N, 77°47'37"W; pocosin dominated by *Gordonia lasianthus*, *Persea borbonia* and *Magnolia virginiana*. 18 March 2003.

Amandinea milliaria (Tuckerman) P. May & Sheard – *Lendemer 707.*
Bathelium carolinianum (Tuckerman) R.C. Harris – *Egan 16048.*
Buellia elizae (Tuckerman) Tuckerman – *Buck 43797.*
Buellia stillingiana J. Steiner – *Egan 16046.*
Bulbothrix confoederata (W.L. Culberson) Hale – *Egan 16041, Egan 16043, Lay 03-0246, Lendemer 740.*
Bulbothrix goebelii (Zenker) Hale – *Lay 03-0244.*
Bulbothrix isidiza (Nylander) Hale – *Lay 03-0247, Lay 03-0248, Yahr 4687.*
Byssoloma meadii (Tuckerman) Ekman – *Buck 43793, Lay 03-0249, Lay 03-0250, Lendemer 748.*
Canoparmelia amazonica (Nylander) Elix & Hale – *Yahr 4688.*
Canoparmelia caroliniana (Nylander) Elix & Hale – *Egan 16040, Egan 16051, Lendemer 924.*
Gyalideopsis spp. – *Buck 43787, Buck 43788.*
Hypotrachyna livida (Taylor) Hale – *Lay 03-0266.*
Lecanora louisianae B. de Lesdain – *Buck 43796.*
Micarea prasina Fries – *Buck 43790.*
Ochrolechia africana Vainio – *Lendemer 699*
Parmelinopsis horrescens (Taylor) Elix & Hale – *Egan 16054.*
Parmelinopsis spumosa (Asahina) Elix & Hale – *Egan 16055, Buck 43800.*
Parmeliopsis subambigua (Gyelnik) Gyelnik – *Lendemer 713.*
Pertusaria hypothamnolica Dibben – *Lendemer 715, Lendemer 716, Lendemer 717.*
Placynthiella icmalea (Acharius) Coppins & P. James – *Lay 03-0286.*
Rimelia reticulata (Taylor) Hale & Fletcher – *Egan 16050.*
Trypethelium virens Tuckerman *ex* Michener *in* Darlington – *Buck 43789, Lay 03-0298, Lendemer 726, Yahr 4690.*
Usnea mutabilis Stirton – *Egan 16044.*

6) North Carolina. Carteret County: Cape Lookout National Seashore, Shackleford Banks, 34°41'01"N, 76°38'22"W; maritime forest dominated by *Quercus virginiana* and *Juniperus silicicola*. 19 March 2003.

Amandinea langloisii Marbach – *Buck 43802, Buck 43844.*
Amandinea milliaria (Tuckerman) P. May & Sheard – *Buck 43840, Yahr 4723.*
Amandinea polyspora (Willey) E. Lay & P. May *in* P. May & Sheard – *Buck 43833, Lay 03-0240.*
Amandinea punctata (Hoffmann) Coppins & Schneider – *Buck 43846.*
Anisomeridium sp. – *Crane 03-43.*
Arthonia spp. – *Buck 43804, Buck 43806, Buck 43808, Buck 43824, Buck 43849.*
Arthopyrenia cinchonae (Acharius) Müll. Arg. – *Buck 43826, Yahr 4704.*
Bacidia heterochroa (Müll. Arg.) Zahlbruckner – *LaGreca 960, Buck 43823.*
Bacidia schweinitzii (Fries *ex* Michener *in* Darlington) Schneider – *Lay 03-0007.*
Calicium abietinum Persoon – *Flenniken 6105.*
Calicium hyperelloides Nylander – *Lendemer 1838.*
Calicium trabinellum (Acharius) Acharius – *Lay 03-0005.*
Canoparmelia caroliniana (Nylander) Elix & Hale – *Flenniken 6106.*
Chaenotheca sp. – *Buck 43838.*
Chrysothrix candelaris (L.) J.R. Laundon – *Crane 03-49, Egan 16062, Flenniken 6107, Yahr 4693.*
Cladonia leporina Fries – *Flenniken 6108, LaGreca 961.*
Cladonia macilenta Hoffmann – *Flenniken 6109.*
Cladonia peziziformis (With.) J.R. Laundon – *Crane 03-50, Crane 03-51.*
Dirinaria aegialita (Afzelius) Moore – *Egan 16075.*
Dirinaria confusa Awasthi – *Crane 03-39, Crane 30-40, Egan 16056, Egan 16063, Flenniken 6110, LaGreca 959, Lendemer 747, Lay 03-0253, Lay 03-0254, Yahr 4724.*
Dirinaria picta (Swartz) Clemens & Shear - *LaGreca 970.*
Enterographa anguinella (Nylander) Redinger (syn. *Enterographa lecanoroides* R.C. Harris) – *Buck 43812, Buck 43816, Buck 43832, Crane 03-48, Egan 16081, Lay 03-0255, Lay 03-0256, Lay 03-0257, Yahr 4707.*
Fissurina insidiosa Knight & Mitten – *Buck 43843, Lay 03-0259, Yahr 4715, Yahr 4717.*
Graphina peplophora Wirth & Hale – *Flenniken 6111.*
Graphis illiterata R.C. Harris – *Yahr 4699.*
Graphis striatula (Acharius) Sprengel – *Lay 03-0261, Yahr 4716.*
Gyrostomum scyphuliferum (Acharius) Nylander – *Lay 03-0262, Yahr 4709.*

Haematomma accolens (Stirton) Hillmann – *Crane 03-45, LaGreca 968, Lendemer 1098.*

Heterodermia albicans (Persoon) Swinscow & Krog – *Egan 16082, Egan 16064, Egan 16061, Flenniken 6112, LaGreca 958, Lay 03-0263, Lay 03-0264, Lendemer 730, Yahr 4696, Yahr 4720.*

Heterodermia speciosa (Wulfen) Trevisan – *Lay 03-0265.*

Lecanora caesiorubella Acharius – *Egan 16071.*

Lecanora caesiorubella ssp. *glaucomodes* (Nylander) Imshaug & Brodo – *Yahr 4726.*

Lecanora hybocarpa (Tuckerman) Brodo – *Lay 03-0267.*

Lecanora louisianae Bains de Lesdain – *Buck 43825.*

Lecanora strobilina (Spengel) Kieffer – *Lay 03-0268.*

Lepotgium austroamericanum (Malme) Dodge - *LaGreca 965.*

Leptogium chloromelum (Acharius) Nylander – *Lay 03-0270, Yahr 4692.*

Leptogium cyanescens (Rabenhorst) Körber – *Buck 43805, Egan 16079, Egan 16077, Lay 03-0271.*

Leptogium milligranum Sierk – *Lay 03-0272.*

**Lichenodiplis lecanorae* (Vouaux) Dyko & Hawksworth – *Buck 43810, Buck 43831, Lendemer 739p.p.* (on *Pertusaria*).

Micarea sp. – *Lendemer 2430.*

Ochrolechia africana Vainio – *Buck 43821, Lay 03-0274, Lay 03-0275, Lay 03-0276, Lendemer 798.*

Parmelinopsis minarum (Vainio) Elix & Hale – *Yahr 4719.*

Parmotrema crinitum (Acharius) Chiosy – *Flenniken 6113.*

Parmotrema hypotropum (Nylander) Hale – *Flenniken 6114.*

Parmotrema hypoleucinum (Steiner) Hale – *Egan 16074.*

Parmotrema perforatum (Jacquin) A. Massalongo – *Crane 03-44, Crane 03-54, Flenniken 6115.*

Parmotrema praesorediosum (Nylander) Hale – *Egan 16067.*

Parmotrema rigidum (Lynge) Hale – *Egan 16058, Lay 03-0279.*

Parmotrema tinctorum (Delise *ex* Nylander) Hale – *Crane 03-42, Egan 16060, Flenniken 6116, Lendemer 673.*

Pertusaria leucostoma (Bernh.) A. Massalongo – *Buck 43829.*

Pertusaria paratuberculifera Dibben – *Buck 43828, Buck 43837, Egan 16076, Lay 03-0281, Lendemer 796, Yahr 4710, Yahr 4718.*

Pertusaria texana Müll. Arg. – *Lay 03-0283, Lendemer 2433.*

Pertusaria xanthodes Müll. Arg. – *Lay 03-0284.*

Phaeographis illitoraticola ined. – *Lendemer 738.*

Phaeographis lobata (Eschweiler) Müll. Arg. – *Buck 43818, Egan 16072, LaGreca 969, Lendemer 704, Yahr 4702.*

Phyllopsora confusa Swinscow & Krog – *Buck 43820.*
Physcia americana G. Merrill – *Crane 03-46, LaGreca 966, Lendemer 922, Yahr 4695, Yahr 4712, Yahr 4713.*
Physcia millegrana Degelius – *Yahr 4694.*
Punctelia rudecta (Acharius) Krog – *Egan 16065, Flenniken 6117, Lay 03-0287, Lendemer 732, Lendemer 733, Yahr 4721.*
Pyrenula concatervans (Nylander) R.C. Harris – *Buck 43803.*
Pyrenula cruenta (Montagne) Vainio – *Buck 43847, Egan 16078, Lay 03-0288, Yahr 4703.*
Pyrenula leucostoma Acharius – *Buck 43819.*
Pyrrhospora varians (Acharius) R.C. Harris – *Lay 03-0289.*
Pyxine subcinerea Stirton – *Flenniken 6118, Lay 03-0291, Lendemer 741, Yahr 4711.*
Ramalina complanata (Swartz) Acharius – *Flenniken 6119, LaGreca 962, LaGreca 967, Lay 03-0024, Lay 03-0026, Lendemer 700.*
Ramalina willeyi Howe – *Crane 03-41, Egan 16080, Flenniken 6120, LaGreca 963, LaGreca 964, Lay 03-0023, Lay 03-0025.*
Rimelia reticulata (Taylor) Hale & Fletcher – *Egan 16066, Egan 16068, Yahr 4700.*
Rimelia subisidiosa (Müll. Arg.) Hale & Fletcher – *Flenniken 6121, Yahr 4697, Yahr 4725.*
Rinodina maculans Müll. Arg. (*R. applanata* H. Magnusson) – *Egan 16081a, Lay 03-0292, Lay 03-0293, Lay 03-0294.*
Sarcographa tricosa (Acharius) Müll. Arg. – *Lay 03-0295, Yahr 4698.*
Schismatomma glaucescens (Nylander *ex* Willey) R.C. Harris – *Lay 03-0241.*
Sphinctrina tubiformis A. Massalongo – *Buck 43839.*
Syncesia sp. – *Yahr 4714.*
Thelotrema defectum Hale – *Lay 03-0014.*
Topelia aperiens Jørgensen & Vézda – *Buck 43827.*
Trichothelium cestrense (Tuckerman *ex* Michener *in* Darlington) R.C. Harris – *Buck 43811.*
Trichothelium raphidospermum (Müll. Arg.) R.C. Harris – *Buck 43815.*
Trypethelium virens Tuckerman *ex* Michener *in* Darlington – *Lay 03-0297.*
Usnea evansii Motyka – *Flenniken 6123, Lay 03-0300.*

7) North Carolina. Carteret County: Bogue Banks, Theodore Roosevelt Natural Area, SW of North Carolina Aquarium, S of Theodore Roosevelt Nature Trail, 34°41'56"N, 76°49'44"W; mature maritime forest dominated by *Quercus virginiana* and *Ilex opaca*. 20 March 2003.

Amandinea punctata (Hoffmann) Coppins & A. Schneider – *Buck 43869, Lay 03-0238.*

Anthracothecium nanum (Zahlbruckner) R.C. Harris – *Yahr 4745.*

Arthonia spp. – *Buck 43850, Buck 43865.*

Bacidia heterochroa (Müll. Arg.) Zahlbruckner – *Buck 43852, Lay 03-0242, Lendemer 712.*

Bacidia polychroa (Fries) Körber – *Yahr 4755.*

Bacidia schweinitzii (Fries *ex* Michener *in* Darlington) G. Schneider – *Buck 43861, Lendemer 1833* (pigment deficient form), *Yahr 4729.*

Bactrospora lamprospora (Nylander) Lendemer – *Lendemer 711, Lendemer 1834, Yahr 4731, Yahr 4748.*

Brigantiaea leucoxantha (Spengel) R. Santesson & Hafellner – *Buck 43862, Egan 16105, Lendemer 734.*

Buellia wheeleri R.C. Harris – *Buck 43863.*

Bulbothrix goebelii (Zenker) Hale – *Egan 16085, Lay 03-0245, Yahr 4747.*

Caloplaca sp. – *Buck 43879, Yahr 4741.*

Catillaria sp. – *Buck 43851.*

Chaenotheca brunneola (Acharius) Müll. Arg. – *Buck 43858.*

Chrysothrix candelaris (L.) J.R. Laundon – *Lay 03-0252.*

Cladonia peziziformis (With.) J.R. Laundon – *Egan 16095, Yahr 4767.*

Cladonia subradiata (Vainio) Sandstede – *Yahr 4766.*

Cryptothecia rubrotincta (Ehrh.) Thor – *Egan 16083, LaGreca 973, Lay 03-0251, Lendemer 702.*

Dimerella lutea (Dickson) Trevisan – Yahr 4762.

Dirinaria aegialita (Afzelius) Moore – *Yahr 4744.*

Dirinaria confusa Awasthi – *Egan, 16097, Lendemer 750.*

Dyplolabia afzelii (Acharius) A. Massalongo – *Egan 16087, Lendemer 746.*

Enterographa anguinella (Nylander) Redinger – *Lay 03-0258.*

Fissurina columbina (Tuckerman) Staiger – *Lay 03-0260.*

Fissurina insidiosa Knight & Mitten – *Buck 43859, Lendemer 710, Yahr 4751, Yahr 4756, Yahr 4760.*

Fissurina subnitidula (Nylander) Staiger (?) – *Yahr 4743.*

Graphis cf. *illiterata* – *Yahr 4735.*

Graphis cf. *librata* – *Yahr 4757.*

Graphis striatula (Acharius) Sprengel – *Yahr 4733.*

Haematomma flexuosum-group – *Yahr 4759.*

Heterodermia albicans (Persoon) Swinscow & Krog – *Flenniken 6124.*

Hypotrachyna osseoalba (Vainio) Park & Hale – *Yahr 4740.*

Lecanora caesiorubella Acharius – *Egan 16102.*

Lecanora strobilina (Sprengel) Kieffer – *Buck 43869a, Lay 03-0269.*

Leptogium azureum (Swartz) Montagne – *Yahr 4730, Yahr 4758.*
Leptogium chloromelum (Swartz *ex* Acharius) Nylander – *Egan 16093.*
Leptogium cyanescens (Rabenhorst) Körber – *Lendemer 745, Lendemer 751, Yahr 4732.*
Lobaria ravenellii (Tuckerman) Yoshimura – *Lendemer 708, Yahr 7427.*
Melaspilea sp. – *Buck 43853.*
Opegrapha sp. – *Yahr 4742.*
Parmotrema hypotropum (Nylander) Hale – *Flenniken 6125, Flenniken 6126.*
Parmotrema hypoleucinum (J. Steiner) Hale – *Egan 16099.*
Parmotrema praesorediosum (Nylander) Hale – *Egan 16094.*
Parmotrema rigidum (Lynge) Hale – *Egan 16089, Egan 16100.*
Parmotrema tinctorum (Delise ex Nylander) Hale – *Flenniken 6127, Lay 03-0280.*
Pertusaria paratuberculifera Dibben – *Lay 03-0282, Yahr 4749.*
Pertusaria xanthodes Müll. Arg. – *Lay 03-0285.*
Phaeographis illitoraticola ined. – *Lendemer 706, Yahr 4691, Yahr 4734.*
Phaeographis inusta (Acharius) Müll. Arg. – *Lay 03-0012.*
Phyllopsora parvifolia (Persoon) Müll. Arg. – *Buck 43864, Yahr 4750.*
Physcia sorediosa (Vainio) Lynge – *Egan 16090.*
Pseudocyphellaria aurata (Acharius) Vainio – *Lendemer 801, Yahr 4728.*
Punctelia rudecta (Acharius) Krog – *Egan 16084.*
Pyrenula anomala (Acharius) Vainio – *Yahr 4739.*
Pyrenula cruenta (Montagne) Vainio – *Egan 16101.*
Pyrenula leucostoma Acharius – *Buck 43872, Yahr 4763.*
Pyrrhospora varians (Acharius) R.C. Harris – *Lay 03-0290.*
Pyxine subcinerea Stirton – *Egan 16086.*
Ramalina stenospora Müll. Arg. – *Egan 16103, Flenniken 6128, Lendemer 670, Lendemer 684.*
Ramalina willeyi Howe – *Egan 16104a, Flenniken 6129, Flenniken 6130, LaGreca 972, Lay 03-0029.*
Ramonia microspora Vézda – *Buck 43860, Lay 03-0028.*
Rimelia reticulata (Taylor) Hale & Fletcher – *Egan 16092, Flenniken 6131.*
Rinodina maculans Müll. Arg. – *Buck 43870, Buck 43873.*
Sarcographa tricosa (Acharius) Müll. Arg. – *Lay 03-0296.*
Thelotrema lathaeum Tuckerman – *Buck 43868, Lay 03-0015, Yahr 4753.*
Thelotrema subtile Tuckerman – *Yahr 4746, Yahr 4754.*
Trypethelium virens Tuckerman *ex* Michener *in* Darlington – *Lay 03-0299.*
Usnea evansii Motyka – *Lendemer 682, Lendemer 802, Lendemer 803, Lendemer 804, Lendemer 805.*
Usnea mutabilis Stirton – *Lendemer 674.*

Usnea pensylvanica Motyka – *Lendemer 683.*

Appendix

Several localities were later visited by R. Yahr and J.C. Lendemer on July 4-5, 2003. These collections are indexed below for completeness. Vouchers are deposited as above.

1) North Calolina. Craven County: *Nyssa* dominated pocosin with a *Lyonia* understory, along the east shore of Catfish Lake, along Forest Service Road #158, ca. ½ mile north of intersection with Catfish Lake Road, Croatan National Forest. Lat. 34° 56' 11"N, Long. 77° 05' 52"W. 4.July.2003

sterile sorediate crustose sp. – *Lendemer 1052.*
Brigantaea leucoxantha (Sprengel) R. Santesson & Hafellner – *Lendemer 1615.*
Byssoloma leucoblepharum (Nylander) Vainio – *Lendemer 1018.*
Byssoloma meadii (Tuckerman) Ekman – *Lendemer 1017.*
Coccocarpia palmicola (Sprengel) Arvidsson & Galloway – *Lendemer 1603.*
Fissurina sp. – *Lendemer 1012.*
Fissurina incrustans Fée – *Yahr 4796, Yahr 4804.*
Graphina sp. – *Lendemer 1022.*
Graphis desquamescens (Fée) Zahlbruckner – *Yahr 4802, Yahr 4805.*
Graphis illiterata R.C. Harris – *Yahr 4803, Yahr 4806.*
Lecania sp. (?) – *Lendemer 1598* (on a hepatic).

> This collection was found overgrowing a hepatic and is characterized by a thin thallus, black lecidine apothecia, 2-celled colorless ascospores, and *Biatora*-type (?) asci. Placement in *Lecania* is a guess.

Nadvornikia sorediata R.C. Harris – *Lendemer 1614.*
Parmelinopsis horrescens (Taylor) Elix & Hale – *Lendemer 1054.*
Pertusaria copiosa Erichsen – *Lendemer 1629.*
Pertusaria epixantha R.C. Harris – *Lendemer 1015.*
Pertusaria obruta R.C. Harris – *Lendemer 1323, Yahr 4800, Yahr 4801,*
Phlyctis ludoviciensis (Müll. Arg.) *ined.* – *Lendemer 1051, Yahr 4795, Yahr 4798, Yahr 4799.*
Pyrenula microcarpa Müll. Arg. – *Yahr 4794.*
Ramonia microspora Vézda – *Lendemer 1328.*
Trichothelium cestrense (Tuckerman *ex* Michener *in* Darlington) R.C. Harris – *Lendemer 1626.*

2) North Carolina. Craven County: On the bark of a tree on the margins of a freshwater swamp, bordering a mixed forest of *Magnolia, Ilex, Quercus, etc*., along a tributary to Otter Creek, several hundred yards northwest of Flanner Beach Road, ca. ½ mile from terminus of Flanner Beach Road (Flanner Beach Camp Ground), Croatan Game Lands. Lat. 34° 58' 54"N, Long. 76° 57' 06"W. 4.July.2003

Bathelium carolinianum (Tuckerman) R.C. Harris – *Yahr 4810.*
Byssoloma sp. – *Lendemer 1087.*
Buellia stillingiana J. Steiner – *Lendemer 1601.*
Fissurina insidiosa Knight & Mitten – *Yahr 4823.*
Fissurina cf. *subnitidula* (Nylander) Staiger – *Yahr 4814, Yahr 4817.*
Graphina cypressi Müll. Arg. – *Yahr 4812, Yahr 4819.*
Graphis illiterata R.C. Harris – *Yahr 4815, Yahr 4818, Yahr 4824.*
Haematomma accolens (Stirton) Hillmann – *Lendemer 1094.*
Leptogium cyanescens (Rabenhorst) Körber – *Lendemer 1621.*
Phaeographis sericea (Eschweiler) Müll. Arg. – *Yahr 4809, Yahr 4822.*
Phaeographis subtigrina (Vainio) Zahlbruckner – *Yahr 4813.*
Porina scabrida R.C. Harris – *Lendemer 1620.*
Pyrenula aspistea (Acharius) Acharius – *Yahr 4825.*
Pyrenula citriformis R.C. Harris – *Yahr 4821.*
Pyrenula leucostoma Acharius – *Lendemer 2431, Yahr 4808.*
Pyrenula microcarpa Müll. Arg. – *Lendemer 2432.*
Thelotrema adjectum Nylander – *Lendemer 1048, Yahr 4816, Yahr 4820.*
Thelotrema lathraeum Tuckerman – *Lendemer 1327, Yahr 4807.*

3) North Carolina. Brunswick County: Pine (*Pinus*) – oak (*Quercus*) sand scrub community, just east of NC Route #17, 1 mile south of intersection with road (NC Route #113) to Orton Plantation, ca. 8 miles north of intersection of NC Routes #113 & #17, southwest of Wilmington. Lat. 34° 07' 25"N, Long. 78° 05' 26"W. – 5.July.2003

Amandinea punctata (Hoffmann) Coppins & A. Schneider – *Lendemer 1025.*
Bactrospora mesospora R.C. Harris – *Lendemer 1019*
Buellia stillingiana J. Steiner – *Lendemer 1619.*
Lecanora cupressi Tuckerman – *Lendemer 1040.*
Lecanora louisianae B. de Lesdain – *Lendemer 1041, Lendemer 1596.*
Hypotachyna osseoalba (Vainio) Park & Hale – *Lendemer 1024.*
Parmelinopsis horrescens (Taylor) Elix & Hale – *Lendemer 1089.*

4) North Carolina. Brunswick County: Dense maritime forest with large *Quercus virginiana*, mostly in various stages of destruction for residential development, Bald Head Island. - Lat. 33° 51' 41"N, Long. 77° 58' 34"W. – 5.July.2003.

sterile sorediate crustose sp. – *Lendemer 1602* (TLC: no substances).
Amandinea punctata (Hoffmann) Coppins & A. Schneider – *Lendemer 1020.*
Arthonia rubella (Fée) Nylander – *Lendemer 1013.*
Buellia wheeleri R.C. Harris – *Lendemer 1321, Yahr 4827.*
Byssoloma leucoblepharum (Nylander) Vainio – *Lendemer 1088.*
Calicium hyperelloides Nylander – *Lendemer 1023.*
Dirinaria confusa Awasthi – *Lendemer 1625.*
Dirinaia picta (Swartz) Clemens & Shear – *Lendemer 1623, Lendemer 1624.*
Dyplolabia afzellii (Acharius) A. Massalongo – *Yahr 4846.*
Enterographa anguinella (Nylander) Redinger – *Yahr 4829.*
Fissurina columbina (Tuckerman) Staiger – *Yahr 4842, Yahr 4847.*
Fiissurina incrustans Fée – *Yahr 4834, Yahr 4844a, Yahr 4850.*
Fissurina insidiosa Knight & Mitten – *Lendemer 1014, Lendemer 1021.*
Graphis dumastii (Fée) Sprengel – *Yahr 4844b, Yahr 4845.*
Graphis lineola Acharius – *Yahr 4837.*
Graphis rigidula Müll. Arg. – *Lendemer 1628, Lendemer 1320, Yahr 4832.*
Gyrostomum scyphuliferum (Acharius) Nylander – *Yahr 4838.*
Haematomma flexuosum-group – *Yahr 4840.*
Lecanora caesiorubella ssp. *glaucomodes* (Nylander) Imshaug & Brodo – *Lendemer 1319.*
Lecanora louisianae de Lesdain – *Lendemer 1597.*
Lecanora subpallens Zahlbruckner – *Yahr 4831, Yahr 4835.*
Micarea prasina Fries – *Lendemer 1627.*
Ocellularia praestans (Müll. Arg.) Hale – *Lendemer 1042.*
Opegrapha viridis (Acharius) Behlen & Desberger – *Yahr 4830.*
Parmotrema rigidum (Lynge) Hale – *Lendemer 1605.*
Parmotrema tinctorum (Nylander) Hale – *Yahr 4851, Lendemer 1616.*
Pertusaria cf. *iners* – *Yahr 4856.*
Pertusaria iners R.C. Harris – *Yahr 4849.*
Phaeographis illitoraticola ined. – *Lendemer 1622, Yahr 4848, Yahr 4855.*
Phaeographis dendritica (Acharius) Müll. Arg. – *Lendemer 1016.*
Phaeographis lobata (Eschweiler) Müll. Arg. – *Lendemer 1055, Yahr 4839.*
Punctelia rudecta (Acharius) Krog – *Lendemer 1049, Yahr 4852.*
Pseudoparmelia uleana (Müll. Arg.) Elix & Nash – *Lendemer 1047, Yahr 4854.*
Pyrenula cruenta (Montagne) Vainio – *Lendemer 1617.*
Pyrenula microcarpa Müll. Arg. – *Lendemer 1665.*
Sarcographa tricosa (Acharius) Müll. Arg. – *Yahr 4833.*

Thellenella rappii R.C. Harris – *Yahr 4836.*
Thelotremataceae sp. (sterile sorediate) - *Lendemer 1613.*
Thelotrema lathraeum Tuckerman – *Lendemer 1322, Lendemer 1666, Yahr 4857.*
Trypethelium virens Tuckerman *ex* Michener *in* Darlington – *Yahr 4858.*
Usnea trichodea Acharius – *Lendemer 1631, Yahr 4853.*

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Dermatocarpon meiophyllizum Vainio in the US Pacific Northwest.

Doug A. Glavich & Linda H. Geiser

Abstract. *The aquatic lichen, Dermatocarpon meiophyllizum, is reported new to Oregon and Washington. The lichen was previously collected in these states but was mistaken for D. luridum. Differentiating characters, new sites, and confirmed historical sites, primarily in northern California, Oregon, Washington, are presented.*

The genus *Dermatocarpon* Eschw. is comprised of foliose, gray- to brown-colored, peritheciate lichens (Heiðmarsson 2000). They are most often found in wet habitats such as stream channels, seeps, and lake-margins. Many members of this genus have a global temperate to arctic distribution (Heiðmarsson 2000, Purvis et al. 1992; Harada 1993) and ten species are known to occur in North America (Esslinger 1997). Seven of the North American species occur in the Pacific Northwest (McCune & Geiser 1997), and one species, *Dermatocarpon luridum* (With.) J. R. Laundon, suspected to be both rare and associated primarily with old-growth forests, was listed for management in the Survey and Manage program of the Northwest Forest Plan (US Dept. of Agriculture & US Dept. of the Interior 2003).

While surveying the Pacific Northwest to better characterize the status and habitat requirements of *D. luridum* for management purposes, we discovered *D. meiophyllizum* Vainio, a lichen that has been only been recently recognized in North America. *Dermatocarpon meiophyllizum* has been collected sporadically in North America in the past few decades, but based on morphological uncertainties within the genus and information available at the time, the specimens were mis-identified as other *Dermatocarpon* species. Heiðmarsson corrected the identity of some of these specimens in the late 1990's. Prior to our study, there were only nine verified *D. meiophyllizum* locations in the United States. Of these records, only one of them is in the Northwest Forest Plan area of northern California (Klamath National Forest, *Ryan 25237b* [ASU]), and there are two other records from California's Sierra Nevada Mountain Range (*Ryan 24666b*; *Ryan 12611-a* [ASU]). The remaining six records are from four localities in Minnesota, and one in Colorado (see 'Representative specimens').

USDA-Forest Service, Siuslaw National Forest, P. O. Box 1148, Corvallis,
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Outside the recently discovered localities of *D. meiophyllizum* in North America, this lichen is well known in Scandinavia, Central Europe, and the British Isles (Heiðmarsson 2000).

During the summers of 2002 and 2003, we surveyed 12 previously reported sites of *D. luridum* and 230 randomly-selected stream sites, all in the area of the Northwest Forest Plan (US Dept. of Agriculture & US Dept. of the Interior 2003), i.e., Washington, Oregon, and California north of San Francisco, from the Pacific Ocean through the Coastal and Siskiyou Ranges up to the crest of the Cascades. Heiðmarsson kindly verified our 2002 field collections, and we identified the 2003 field collections using vouchers from the 2002 field season and the taxonomic concepts of Heiðmarsson (2000). All new collections of aquatic *Dermatocarpon* from previously reported sites of *D. luridum* and from the randomly selected sites were *D. meiophyllizum*. Therefore, it is likely that *D. meiophyllizum* has been mistaken for *D. luridum* in the Pacific Northwest.

Confusion regarding the identification of *Dermatocarpon* species is not surprising; Heiðmarsson (2000) only recently tackled the taxonomic uncertainties of this genus. A few basic characters are now known to clearly distinguish *D. luridum* from *D. meiophyllizum* (Heiðmarsson 2000). *Dermatocarpon luridum* is easily recognized by its many-lobed thallus, the presence of multiple holdfasts, and a red medullary reaction to Melzer's reagent. In contrast, *Dermatocarpon meiophyllizum* has a small, umbilicate thallus and a negative medullary Melzer's reagent reaction. In natural aquatic habitats of Pacific Northwest forests, we have observed that *D. meiophyllizum* frequently grows in tight clusters consisting of many small thalli and can therefore appear, at first, to be the multi-lobed *D. luridum*. Upon closer inspection, however, these colonies are comprised of small, individual, umbilicate thalli.

Representative specimens

Vouchers for the following records are located in the Oregon State University Herbarium (OSC) unless otherwise noted.

CALIFORNIA. Alpine Co., End of Clark fork road at edge of Carson-Iceberg Wilderness, *Ryan 24666b* (ASU). Humboldt Co. Headwaters of the Middle Fork of Mill Creek in the Trinity Alps Wilderness, Six Rivers National Forest, *Miles 030628*; Outlet creek of pond near the summit of Black Lassic in Six Rivers National Forest, *Glavich 616*. Inyo Co., Eastern Brook Lakes Watershed, Sierra Nevada Mountains, *Ryan 12611-a* (ASU). Siskiyou Co., Shackleford

Creek in Klamath National Forest, *Ryan 25237b* (ASU); Headwaters of Backmeadow Creek in the Marble Mountain Wilderness, Klamath National Forest, *Miles 030721*; Headwaters of the South Fork of the Salmon River near South Fork Lake in the Trinity Alps Wilderness, Shasta-Trinity National Forest, *Glavich 615*. Trinity Co. Grizzly Creek near Grizzly Meadows in the Trinity Alps Wilderness, Shasta-Trinity National Forest, *Carlson 030807*; North Fork of Swift Creek in Poison Canyon in the Trinity Alps Wilderness, Shasta-Trinity National Forest, *Nadel 031026*. COLORADO. Rio Grande Co. Near campground in Beaver Creek State Wildlife Area, *Wetmore 17213* (MSN). MINNESOTA. Lake Co. South end of Snowbank Lake in Superior National Forest, *Wetmore 82208* (MSN); South Kawashiwi River in Superior National Forest, *Wetmore 82206*. St. Louis Co. Partridge River in Superior National Forest, *Wetmore 82209* (MSN); Mukooda Lake in Voyageurs National Park, *Wetmore 40436* (MSN); Anderson Bay in Voyageurs National Park, *Wetmore 38804* (MSN). OREGON. Deschutes Co. Unnamed creek headwaters near Broken Top mountain tarn in the Three Sisters Wilderness, Deschutes National Forest, *Wisehart 020817*; Spring outlet near Green Lake in the Trinity Alps Wilderness, Deschutes National Forest, *Wisehart 020806*; Snow Creek Watershed in Deschutes National Forest, *Annegers 020805*. Douglas Co. Lower Jackson River in Umpqua National Forest, *Nadel 030827-1*. Jackson Co. Glade Creek Watershed, *Kahan 020914*. Lane Co. Lookout Creek in H. J. Andrews Experimental Forest, *Gillock 020618*; Stream channel of the Blue River in Willamette National Forest, *Miles 030620*. WASHINGTON. Kittitas Co. South Fork Taneum Creek near South Fork Meadow in Wenatchee National Forest, *Nadel 020924*. Jefferson Co. Copper Creek approximately 2 km down stream from Buckhorn Lake in the Buckhorn Wilderness, Olympic National Forest, *Kahan 020815*. Skamania Co. Big Lava Creek Watershed in Gifford Pinchot National Forest, *Annegers 020820*; East Fork Lewis River near confluence with Green Fork in Gifford Pinchot National Forest, *Nadel 020724*; Slide Creek in Gifford Pinchot National Forest, *Gillock 020725*; East Fork Lewis River near Sunset Campground, *Nadel 020828*. Okanogan Co. Unnamed creek near Grasshopper Pass in Okanogan National Forest, *Kahan 020928*. Whatcom Co. Wells Creek Watershed in Mt. Baker–Snoqualmie National Forest, *Nadel 020907-1*.

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Additions to the Liverwort Flora of Connecticut

Norton G. Miller[1]

Abstract. *The leafy liverworts,* Cladopodiella francisci *and* Nardia insecta *are newly documented for the flora of Connecticut. Additional records for two other hepatics,* Frullania plana *and* Metzgeria crassipilis, *are presented. The relatively few reported collections of these four species indicate that they are rare or uncommon species in the northeastern United States.*

Evans and Nichols's book (1908) about Connecticut bryophytes contains extensive introductory and bibliographical information, keys, and distributional records of species. As the first such published flora for one of the United States, it helped stimulate the study of mosses, liverworts, and hornworts in eastern North America in the early 1900s. Nevertheless, so little has been published on Connecticut bryophytes during the last 80 years that one may question whether there is much new to be discovered about the distribution of bryophytes in this state beyond what Evans and Nichols ably presented in 1908 and Nichols and Evans updated in later papers (e.g., Evans, 1923; Nichols, 1910, 1911, 1912, 1913).

In recent years, however, an interest in Connecticut bryophytes has been rekindled. In 1991, the 16th A. LeRoy Andrews Foray was held in northwestern Connecticut (Slack et al., 1993). Two more conferences, one in 2002, visited several localities in eastern and northwestern parts of the state, and another Andrews Foray, the 28th, in 2003 explored the region surrounding Sharon, also in northwestern Connecticut. Participants discovered important range extensions, including records of species not before reported for the state, during the conferences. These results suggest that there is still much to be discovered about the bryoflora of Connecticut.

As part of the annual meeting of the American Bryological and Lichenological Society in 2002, Dr. Bernard Goffinet of the University of Connecticut, Storrs, organized and led field trips to several bryologically productive sites in eastern and northwestern Connecticut. Of these, three places in the northeastern part of the state produced noteworthy Hepaticae: outcrops and slopes along Boston

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Hollow Road (Town of Ashford, Windham County), Fifty Foot Cliff (Town of Mansfield, Tolland County), and Bolton Notch (Town of Bolton, Tolland County).

Among my collections from these localities was material of the following two species not previously credited to the flora of Connecticut, so far as I have been able to determine. Otherwise, they are rare species in the northeastern United States.

Cladopodiella francisci (Hook.) H. Buch *ex* Joerg. Tolland Co., Bolton Notch State Park, Bolton Notch, 41°47'18"N, 72°26'55"W; damp face of shaded schist bluff, 25 Jul 2002, *Miller 14,084*.—This hepatic has been collected in eastern North America at scattered places between Baffin Island, Canada, and easternmost Long Island (Schuster, 1974). Most of the known stations in the eastern United States are either near the Atlantic Ocean (eastern Maine [Haynes, 1903, 1906]; Long Island) or at high altitudes in the mountains of northeastern New York, New Hampshire, and Maine. For example, I have found it to be abundant in the alpine zones of the MacIntyre Range (Algonquin Peak summit cone and between Algonquin and Boundary Peaks), Mt. Marcy, and Mt. Skylight in the Adirondacks, and I have also collected it on the Tableland of Mt. Katahdin, Maine. The Connecticut station is 60 km from the Atlantic Coast. It and other lowland collections cited by Schuster (1974) suggest that more populations between the coast and the high mountains will be found.

Plants of *C. francisci* are generally reddish and they form a tight, thin turf when growing in their typical habitat, exposed sandy or peaty mineral soil. Plants in the Connecticut population, however, were laxer and greener than most I have studied, reflecting the deeply shaded habitat where it was found in Bolton Notch. The Connecticut plants were sparsely gemmiparous, and both male and female plants grew intermixed.

Nardia insecta Lindb. Tolland County, Bolton Notch, other data as given above; wet schist bedrock in shade, 25 Jul 2002, *Miller 14,085*, *14,086*.—Only a few eastern North American collections of this uncommon leafy hepatic were cited by Schuster (1969), including some from Nova Scotia, the mountains of Maine and New Hampshire, and southeastern New York and eastern Long Island. I have collected it in the Adirondack Mountains at the Cascade Lakes and near Paul Smiths in Essex County (Miller, 1966). Some of the Connecticut plants have young shoot-perianths with developing sporophytes. In the region of North America treated by Schuster (1969), *Nardia geoscyphus* (De Not.)

Lindb. *in* Carr. is more common than *N. insecta*. Both species have two or three (rarely more) large, ovoid, granular oil bodies in leaf cells. *Nardia insecta* has bifid leaves below the shoot-perianth, whereas leaves of *N. geoscyphus* not associated with the shoot-perianth are entire or emarginate. *Nardia geoscyphus* has been recorded from Bolton, Connecticut, where it was collected by Annie Lorenz (Evans, 1914).

Three additional collections I made on the 2002 field trips are noteworthy, although the two species represented have previously been reported from Connecticut. Both are uncommon species in the eastern United States.

Frullania plana Sull. Windham County, along Boston Hollow Road, ca. 41°55'42"N, 72°10'W; face of bedrock ledge on top of boulder, southeast-facing slope in mixed, mesic forest; 24 Jul 2002, *Miller 14,031*; autoicous; with perianths.—Stations in Massachusetts and Connecticut are at the northern end of the range of this eastern North American endemic, which occurs southward to northern Georgia, and also in the Arkansas Ozarks (Schuster, 1992). Evans and Nichols (1908) cite one prior collection from New Haven County.

Metzgeria crassipilis (Lindb.) Evans. Windham County, along Boston Hollow Road, ca. 41°55'42"N, 72°10'W; vertical face of boulder, ledge and boulder area of southeast-facing slope, mixed mesic forest, 24 Jul 2002, *Miller 14034B*. Tolland County, Fifty Foot Cliff, 41°47'20"N, 72°13'W; side of boulder in deciduous forest, 24 Jul 2002, *Miller 14,050*.—Both collections have the characteristic discoidal gemmae on the upper thallus surface. Evans (1909), in elevating *M. furcata* (L.) Dum. var. *crassipilis* Lindb. to the rank of species, cited two collections from New Haven County, Connecticut, in describing the range of the species as it was understood at the time. Schuster (1992) added no additional stations from Connecticut and cites specimens or records in an area between Nova Scotia and Georgia, in addition to mentioning its occurrence in Mexico and Central America and Japan.

Acknowledgments. Herbaria at Yale University (YU) and the University of Connecticut, Storrs (CONN), were checked by Nico Cellinese and Bernard Goffinet, respectively, for unreported Connecticut state liverwort records, and I am grateful for this assistance. The voucher specimens are in the Bryophyte Herbarium of the New York State Museum (NYS), with duplicates at CONN.

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Guide to contributors to *EVANSIA*

The aim of *Evansia* is to provide a vehicle for the presentation and exchange of useful information on North American bryophytes and lichens. Articles are frequently popular in nature rather than technical and are intended to teach and inform both amateurs and professionals. The articles include, but are not restricted to, announcements of and reports on forays and meetings, presentations of techniques and aids for studying and curating lichens and bryophytes, and reports on local floras. Checklists and papers documenting new regional, state, or county records must include voucher specimens (collector and collection number) and an indication of where the specimens are deposited or a literature reference.

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Evansia to get new Editor

Beginning with Volume 22, (2005) Evansia will have a new Editor.

Larry St. Clair has agreed to take on the editorial duties of the journal and is working closely with the current editor to provide a smooth transition for both authors and subscribers. Some changes will be introduced over the next few issues to improve the format and scientific content of the journal. These changes will be announced as they develop.

Manuscripts can now be sent to Dr. St. Clair at the address below. Authors should review carefully the Guide to Contributors for changes to those instructions and addresses for submission of papers.

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The Anomodontaceae (Musci) in Maine

Bruce Allen

The Anomodontaceae were established by Buck & Vitt (1986) for a group of genera with prostrate primary stems, short leaf cells, and narrow, often white, papillose exostome teeth. They placed the family in the Leucodontales, near the Cryphaeaceae. Of these features only its prostrate primary stems are germane to a consideration of its familiar relationships. Similar leaf cells are found in a number of Leucodontales and Hypnales families. The exostome in the Anomodontaceae is often yellowish, sometimes reddish at base; structurally its peristome closely approximates that of *Leskea* Hedw.

Although the Anomodontaceae and Neckeraceae have never been considered close, there is considerable morphological similarity between the Thamnoid members of the Neckeraceae and the Anomodontaceae. Both groups have prostrate primary stems with erect secondary stems, attenuate-flagellate branch and stem tips, similar peristomes, often wavy costae, and short, rhomboidal leaf cells. The Thamnoid genera generally have complanate leaves, and although this is not a typical feature of the Anomodontaceae there are *Anomodon* species (*e.g.*, *A. minor* (Hedw.) Lindb.) with complanate leaves. Even the distinctive dentate leaf margins of *Herpetineuron toccoae* (Sull.) Card., an anomalous feature in the Anomodontaceae, have a close counterpart in many of the Thamnoid species of the Neckeraceae.

There have been many genera placed in the Anomodontaceae since its inception, but only *Anomodon* Hook. & Tayl, *Herpetineuron* (C. Müll.) Card., *Haplohymenium* Dozy & Molk., and *Miyabea* Broth. seem to belong there. *Thelia* Sull. *in* Sull. & Lesq. has been placed in the Anomodontaceae (Buck & Vitt 1986, Buck 1998). That genus, however, differs significantly from the Anomodontaceae in having rhizoids arising from numerous, diffuse initials, stem paraphyllia, and stem leaves that often have short, double costae.

Plants small, medium or robust, in cushions, tufts, or mats on rocks or trees. Primary stems creeping, leaves reduced, often widely spaced; rhizoids red-brown, in moderate-sized clusters from initials at abaxial side of leaf insertions, not or weakly and irregularly branched. Secondary stems erect, erect-ascending, or loosely spreading, simple or variously branched, secondary stems and

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branches at times transformed at the tips into stolons or flagellate branches, in cross-section sclerodermis present, cortical cells enlarged, central stand present

or absent; paraphyllia absent, pseudoparaphyllia present or absent. Secondary stem leaves and branch leaves similar or differentiated, decurrent or non-decurrent; apices acuminate, acute, or broadly rounded to obtuse; margins plane, erect, or recurved; costae single, strong, reaching beyond midleaf, often wavy above, in cross-section cells homogeneous, thick-walled; leaf cells quadrate, rounded-quadrate, subquadrate, oblate, or irregularly hexagonal, smooth, bulging-mammillose or densely pluripapillose, juxtacostal cells near the insertion differentiated. Dioicous. Setae elongate. Capsules erect, more or less symmetric, globose, oblong-ovate, or elliptic; stomata present or absent; opercula obliquely or straight conic-rostrate to rostrate; annuli rudimentary or compound; peristome double, exostome teeth white to yellow, at times reddish-orange at base, narrowly triangular to linear, dorsal (outer) surface papillose-striate at base and papillose above or papillose throughout, trabeculae variously projecting, endostome papillose, long or rudimentary, segments narrow and perforate or reduced to stubs, basal membrane low, cilia rudimentary or absent. Spores papillose. Calyptrae cucullate, smooth or sparsely hairy.

1. Leaf tips generally firm and intact, although lamina often fragile, leaf cells densely pluripapillose, papillae obscuring the cell lumina .... 1. *Anomodon*
1. Leaf tips and lamina fragile, most leaf apices broken off, leaf cells pluripapillose and bulging mammillose, papillae not obscuring the cell lumina .... 2. *Haplohymenium*

1. *Anomodon* Hook. & Tayl., Muscol. Brit. 79. 1818.

Plants small, medium, or robust, in dull, dark-green, to yellow-green, lax or dense mats. Primary stems creeping, leaves reduced, at times scale-like; rhizoids red-brown in clusters at abaxial side of leaf insertions, not or weakly and irregularly branched. Secondary stems erect to loosely spreading, simple or variously branched, secondary stems and branches at times transformed at tips into stolons or attenuate-flagellate branches, in cross-section sclerodermis well-developed, cortical cells enlarged, central stand present or absent; paraphyllia absent, pseudoparaphyllia present or absent. Secondary stem and branch leaves similar or differentiated, ovate-lanceolate, oblong-lanceolate, oblong-ligulate, or lance-ligulate from an ovate base, decurrent or non-decurrent; apices acute, broadly rounded to obtuse, at times apiculate; margins plane, erect, or recurved, entire or sparsely serrulate; costae single, ending below the apex, yellow, often wavy above, in cross-section cells homogeneous, thick-walled; leaf cells quadrate, oblate, or irregularly hexagonal, densely pluripapillose, juxtacostal cells near the insertion elongate, straight-walled or porose, weakly papillose to smooth. Dioicous. Setae elongate. Capsules erect, more or less symmetric; stomata present or absent; opercula obliquely or straight conic-rostrate; annuli rudimentary or compound; peristome double, exostome teeth white to yellow, at times reddish-orange at base, narrowly triangular to linear, dorsal (outer) surface papillose-striate at base or papillose throughout, trabeculae variously projecting, endostome papillose, to ¾ the exostome length or rudimentary, segments narrow and perforate or reduced to stubs, basal membrane low, cilia rudimentary or absent. Spores spherical, subspherical, or oblong, lightly papillose. Calyptrae cucullate, smooth.

Anomodon is a north temperate genus of 18 species (Crosby *et al.* 2000) also found in Mexico, Central America and the Caribbean. It has creeping primary stems and long, erect, variously branched secondary stems. *Anomodon* leaves are mostly ovate at base with apices that vary from slender acuminate to broadly obtuse. Its juxtacostal leaf cells near the insertions are elongate and smooth to weakly porose, otherwise the cells are short and densely pluripapillose. The species of *Anomodon* are so similar in overall aspect that it is seems clear they represent a nature group, but they also exhibit remarkable character state variation: a stem central strand, pseudoparaphyllia, stomata, and compound annulus can be present or absent. The peristome also is variable, *e.g.*, the exostome can be white, yellowish, or faintly red, papillose throughout or horizontally striate at base, and the endostome varies from ¾ the exostome length to rudimentary.

The leaf cell papillae in *Anomodon* are massive and often forked in a manner normally associated with Pottiaceae species. The genus, however, is closely linked to the smooth-celled *Herpetineuron* (C. Müll.) Card. The characteristic sinuose costa of *Herpetineuron* occurs in a weaker, flexuose to wavy state in all species of *Anomodon*, and the juxtacostal basal leaf cell differentiation of *Anomodon* is found in *H. acutifolium* (Mitt.) Granzow. Although most *Anomodon* species have papillose-crenulate leaf margins, there are some species with irregularly dentate (*A. attenuatus*) or coarsely serrate (*A. dentatus* Gao) leaf margins that approach those seen in *H. acutifolium*.

Anomodon has often been associated with the Leskeaceae or Thuidiaceae since sporophytically it resembles the Leskeaceae, but gametophytically the

Thuidiaceae (see discussion in Granzow-de la Cerda 1997). Buck and Vitt (1986), however, placed the genus in the Anomodontaceae, and moved it to the Leucodontales near the Cryphaeaceae. The positioning of the Anomodontaceae in the Leucodontales is based on the differentiation of its stems into creeping primary stems with reduced leaves and erect, secondary stems with full-sized leaves. *Anomodon* shows some similarity to the Thamnoid genera of the Neckeraceae in costal and leaf form, especially in those members of the genus that have more or less asymmetric, complanate leaves (*e.g.*, *A. minor*).

Anomodon was revised by Granzow-de la Cerda (1997). A revision of the east Asiatic species of *Anomodon* (Iwatsuki 1963) has excellent illustrations and is an extremely useful work for those interested in the genus.

The name *Anomodon* combines the Greek *a* (not), *nomo* (law or rule), and *odon* (tooth), and refers to the mistaken observation that its endostome segments came from the same cell layers as the exostome teeth.

1. Leaves hyaline hair-pointed, upper margins revolute......... 3. *A. rostratus*
1. Leaves not hair-pointed, margins plane or revolute only at base 2
    2. Leaves rounded-auriculate, not decurrent, basal margins with fimbriate papillae, pseudoparaphyllia present .. 4. *A. rugelii*
    2. Leaves not auriculate, decurrent, basal margins with crenulate papillae or dentate, pseudoparaphyllia absent 3
3. Leaf apices acute, often serrulate; upper dorsal costal cells subquadrate; stomata present; annulus rudimentary; stems and branches often stoloniform-attenuate .... 1. *A. attenuatus*
3 Leaf apices broadly rounded to obtuse, entire; upper dorsal costal cells elongate; stomata absent; annulus complex, with vesiculose cells; stems and branches not or rarely stoloniform-attenuate 4
    4. Leaves flexuose to incurved-contorted when dry, abruptly narrowed above the middle, more than 2.0 mm long, costa not or rarely forked above .... 5. *A. viticulosus*
    4. Leaves erect-imbricate when dry, gradually narrowed above the middle, less than 2.0 mm long, costa often forked above ....2. *A. minor*

1. *Anomodon attenuatus* (Hedw.) Hüb., Muscol. Germ. 562. 1833.
    Leskea attenata Hedw., Sp. Musc. Frond. 230. 1801.
    Hypnum attenuatum (Hedw.) Sm., Fl. Brit. 3: 1804, illegitimate homonym, not *Hypnum attenuatum* Dicks *ex* With. 1801.

Plants medium-sized, in dull, dark-green or yellow-green mats. Primary stems creeping, leaves reduced, 0.3–0.5 mm long, well-spaced, scale-like to triangular; leaf cells variously papillose to nearly smooth; rhizoids red-brown, in clusters at abaxial side of leaf insertions, not or weakly and irregularly branched. Secondary stems horizontal, often transformed to stolons at the tips, or erect and loosely spreading, to 5 cm long, irregularly branched, the branches usually decurved when dry, often ending in attenuate to flagellate tips, in cross-section sclerodermis of 2–5 rows of small, red-brown, thick-walled cells, cortical cells enlarged, yellow to hyaline, firm- or thick-walled cells, central stand absent; paraphyllia and pseudoparaphyllia absent. Secondary stem leaves oblong-lanceolate, to 2 mm long. Branch leaves erect and homomallous when dry, erect-spreading when wet, ovate-lanceolate from an ovate base, to 1.5 mm long, long and broadly decurrent; apices acute and apiculate; margins plane or erect at base, papillose-crenulate, at times sparsely serrulate at the apex, denticulate at the base of the decurrencies; costae single, ending well below the apex, yellow, wavy above, channeled on ventral surface, with quadrate, densely papillose cells on upper dorsal surface, in cross-section cells homogeneous, thick-walled, cells quadrate, oblate, or irregularly hexagonal, 5–9 µm, densely pluripapillose by thick, branched, or c-shaped papillae; leaf cells near the apex lightly papillose to nearly smooth, juxtacostal cells near the insertion long-rectangular, to 30 x 12 µm, porose, weakly papillose to smooth, cells in the basal decurrencies enlarged, smooth to weakly papillose. Dioicous. Perigonia and perichaetia gemmate, lateral on secondary stems. Setae elongate-flexuose, red to orange, to 20 mm long. Capsules erect, 2–3 mm long, smooth, light-brown; exothecial cells small, oblate, thick-walled in 3–5 rows below the mouth, becoming subquadrate and short-rectangular below; stomata at junction of urn and seta; opercula obliquely or straight conic-rostrate, to 1 mm long; annuli rudimentary, cells often clinging to capsule mouth or operculum; exostome white to yellow above, reddish-orange at base, narrowly triangular to linear, on dorsal (outer) surface papillose-striate in lower half, papillose above, trabeculae laterally projecting, endostome papillose, to ¾ the exostome length, segments narrow and perforate, basal membrane low, cilia rudimentary or absent. Spores spherical, subspherical, or oblong, lightly papillose, 9–16 µm. Calyptrae cucullate, smooth, 2–2.5 mm long. n = 10 + m, 11 (Fritsch 1991).

On bark at base of trees (*Acer*, *Betula, Fagus*, *Sambucus*, and *Quercus*), over limestone outcrops, on humus or soil over boulders in woods. Also found on relic-shell heaps, rocks along streams, and on bridge abutments. In Maine known from Androscoggin (*Allen 14739* MO), Aroostook (*Pursell 11386* MO),

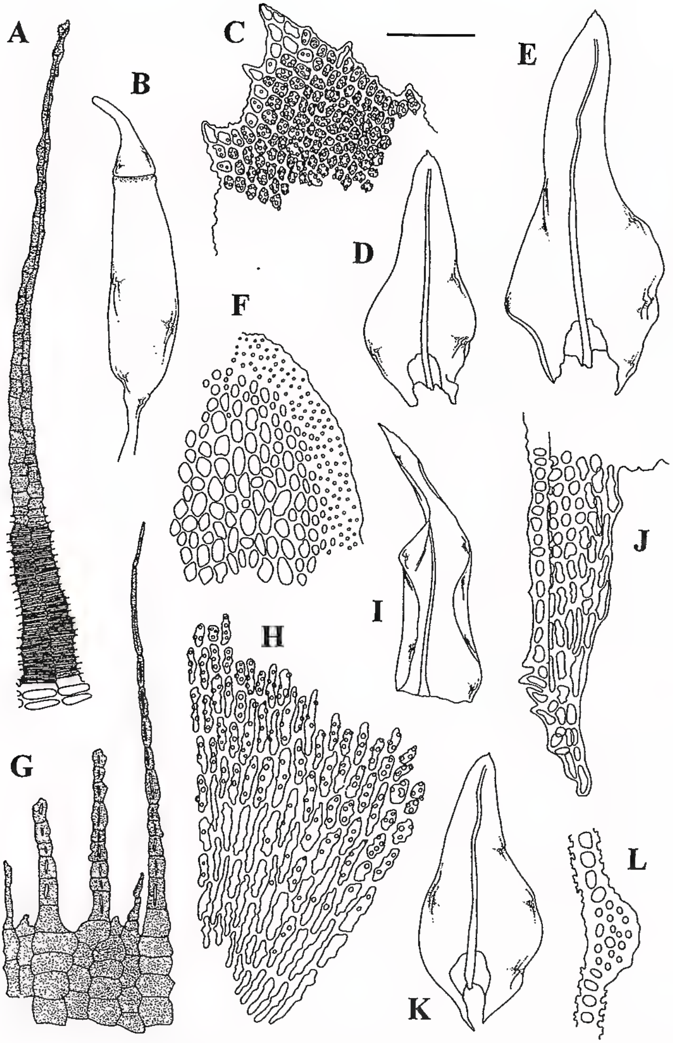

Figure 1. *Anomodon attenuatus*. A. Exostome tooth, dorsal (outer) surface. B. Capsule and operculum. C. Leaf apex. D. & K. Branch leaves. E. Secondary stem leaf. F. Stem in cross section. G. Endostome, inner (ventral) surface. H. Basal leaf cells. I. Perichaetial leaf. J. Leaf decurrency. L. Costa in cross section. Scale in mm: bar = 0.05 (L), bar = 0.06 (C, H, J), bar = 0.08 (F), bar = 0.09 (A, G), bar = 0.34 (I), bar = 0.5 (D, E, K), bar = 0.9 (B). Figures A, B,G,I from *Allen 14997* (MO), figures C,D–F,H,J–L from *Allen 20032* (MO).

Cumberland (*Allen 15914* MO), Franklin (*Allen 21384* MO), Hancock (*Allen 22119* MO), Kennebec (*Allen 24769* MO, NY), Knox (Allen & Pursell *Maine Mosses 75* DUKE, MAINE, MO, NY, US), Lincoln (*Allen 9255* MO), Oxford (*Ledlie 88* MO), Penobscot (*Allen 16501* MO), Piscataquis (*Merrill 127* NEBC), Sagadahoc (*Allen 21741* MO), Somerset (*Allen 9369* MO), Waldo (*Allen 24427* MO), and York (*Allen 24414* MO) Counties.

Anomodon attenuatus usually has numerous branch and secondary stems tapered into long, slender, attenuate tips. This feature along with a dry aspect in which the branches are decurved and the leaves are firm, erect below and curved to homomallous above enable the plants to be recognized in the field. The long, decurrent leaf bases in *A. attenuatus* are noteworthy not only in their length, but also in usually having serrate to dentate margins. This last feature is also seen in several Orthotrichaceae genera. The branch leaves of *A. attenuatus* are broader and more apically rounded than the secondary stem leaves and their apices are either entire or weakly serrulate. Sporophytes of *A. attenuatus* are apparently rare in North America, *e.g.*, of 510 *A. attenuatus* collections examined at MO only 35 (7 percent) had sporophytes. The exostome teeth in *A. attenuatus* are characteristically white throughout when old, but when first exposed they are orange to red at base.

The presence of hyaline hair points and leaf margins that are recurved to near the apex immediately separate *A. rostratus* from *A. attenuatus*. Although the leaf margins in *A. attenuatus* are mostly plane, the lower margins (especially on the branch leaves) can be erect to somewhat recurved. *Anomodon minor* and *A. attenuatus* are similar in having stiffly erect, non-contorted leaves when dry, but in *A. minor* the leaves are erect throughout and the leaf apex is broadly rounded to rounded-obtuse, entire, and not apiculate. Granzow-de la Cerda (1997) also separates these species by the presence (*A. minor*) or absence (*A. attenuatus*) of papillae on the dorsal costal surface. However, in *A. minor* the upper dorsal costal cells are distinct and have seriate papillae, while in *A. attenuatus*, especially on the branch leaves, the dorsal surface of the costa is covered by quadrate, densely papillose cells. Another good feature that distinguishes the two species is the relative development of their juxtacostal, basal leaf cells. In *A. attenuatus* these yellowish, elongated, often porose cells are exceptionally well-developed. Furthermore, they are equally developed on both sides of the costa. In *A. minor* these cells are poorly developed, and long-rectangular on one side but rectangular to quadrate on the other side of the costa.

Anomodon attenuatus and *A. rugelii* are similar in often having apiculate leaves, and *A. rugelii* can have irregularly dentate upper leaf margins. *Anomodon rugelii* differs from *A. attenuatus* in having fragile leaf laminae that are erect-incurved when dry. Microscopically the presence in *A. rugelii* of stem pseudoparaphyllia, leaves with broadly rounded, non-decurrent, auriculate leaf bases that are fimbriate-papillose at the margins, smooth, elongate cells on the upper dorsal costal surface, and weakly differentiated basal juxtacostal cells distinguish it from *A. attenuatus*.

2. *Anomodon minor* (Hedw.) Lindb., Bot. Not. 1865: 196. 1865.
Neckera viticulosa var. *minor* Hedw., Sp. Musc. Frond. 210. 1801.
Neckera minor (Hedw.) P. Beauv., Prodr. Aethéogam. 78. 1805.

Plants small to medium-sized, in dull, bright-green when wet, dark-green when dry mats. Primary stems creeping, leaves reduced, 0.4–0.6 mm long, well-spaced, scale-like, oblong-ligulate from an ovate base, wide-spreading to squarrose at tips, cells more or less smooth below, densely papillose above; rhizoids red-brown in clusters at abaxial side of leaf insertions, not or weakly and irregularly branched. Secondary stems erect-ascending, to 2 cm long, not or sparsely and irregularly branched, in cross-section sclerodermis of 2–5 rows of small, red-brown, thick-walled cells, cortical cells enlarged, yellow to hyaline, firm- or thick-walled cells, central stand present; paraphyllia and pseudoparaphyllia absent. Secondary stem leaves erect-imbricate when dry, spreading to widely spreading when wet, oblong-ligulate from an ovate base, 1–2 mm long, rounded to rounded-obtuse, broadly decurrent; apices not apiculate; margins plane, papillose-crenulate, denticulate at the base of the decurrencies; costae single, ending well below the apex, yellow, wavy above, usually forked at apex, channeled on ventral surface, upper dorsal costal cells elongate, often seriate papillose, in cross-section cells homogeneous, thick-walled; juxtacostal leaf cells in lower part of leaf bistratose, upper cells mostly unistratose with bistratose patches scattered throughout the upper lamina, cells quadrate, oblate, or irregularly hexagonal, 5–12 µm, densely pluripapillose by thick, branched, or c-shaped papillae, juxtacostal cells near the insertion on one side short rectangular to quadrate, papillose, on the other long-rectangular, to 16–35 µm long, smooth, not porose. Dioicous. Perigonia not seen. Perichaetia gemmate, lateral on secondary stems, to 1.5 mm long. Setae elongate, yellowish, 6–12 mm long. Capsules erect, oblong to cylindric, 1.5–2.5 mm long, smooth, to lightly furrowed when dry, light-brown; exothecial cells small, oblate, thick-walled in 1–2 rows below the mouth, becoming subquadrate and short-rectangular below; stomata absent; opercula obliquely or straight conic-rostrate 0.5–0.75 mm long;

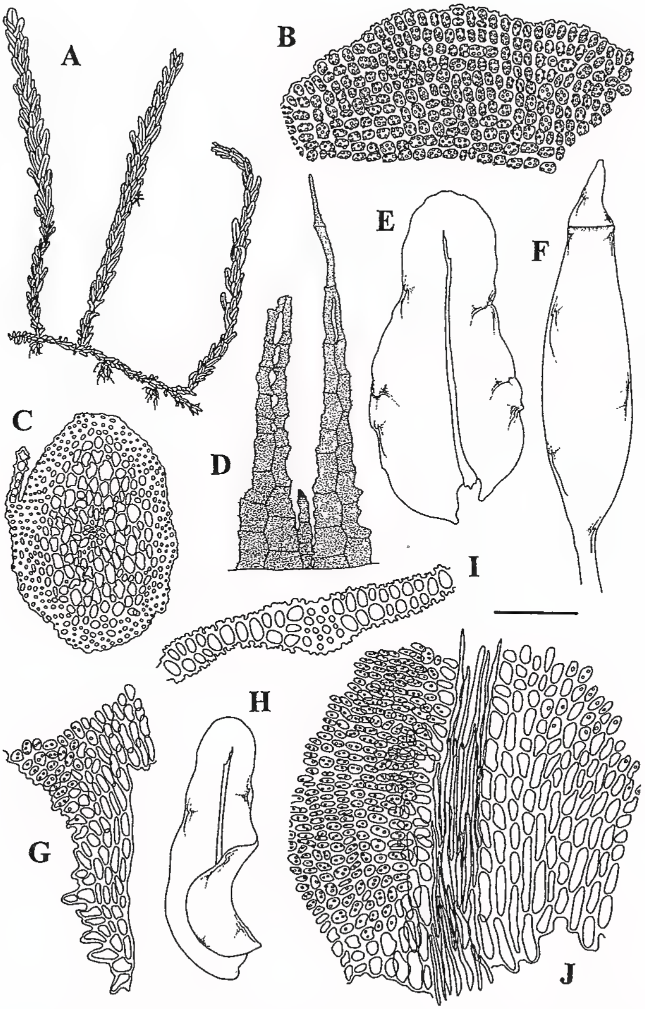

Figure 2. *Anomodon minor*. A. Habit. B. Leaf apex. C. Stem in cross section. D. Exostome teeth outer (dorsal) surface and rudimentary endostomial segment. E. & H. Leaves. F. Capsule and operculum. G. Leaf decurrency. I. Leaf cross section below midleaf. J. Basal leaf cells. Scale in mm: bar = 0.06 (B, D, G, I, J), bar = 0.08 (C), bar = 0.6 (F), bar = 0.5 (E, H), bar = 3.0 (A). Figures D, F from *Musci Boreali Americani (ed. 2) 360* (MO), fig. G from *Allen 10097* (MO), all others from *Allen 23770* (MO).

annuli complex of 2–3 rows of vesiculose cells often clinging to capsule mouth and operculum; exostome pale-yellow, reduced, narrowly triangular to linear, dorsal (outer) surface papillose throughout, trabeculae weakly developed, endostome rudimentary, segments and cilia absent or reduced to short stubs, basal membrane low. Spores anisosporous, 9–11 μm and 14–18 μm, subspherical, or oblong, nearly smooth to lightly papillose. Calyptrae cucullate, smooth, 2.5–3 mm long. n = 10 + m (Fritsch 1991).

On bark at base of trees in woods. In Maine known from Oxford (Allen & Pursell *Maine Mosses 282* DUKE, MAINE, MO, NY, US) and Penobscot (*Merrill 126* MO, NEBC) Counties. Reported from Kennebec (Pitman 1928) County.

Anomodon minor is a small to medium sized species with broadly rounded, entire leaves that are erect-imbricate and not or scarcely contorted when dry. The hyaline hairpointed leaves of *A. rostratus* with strongly recurved leaf margins distinguishes it from *A. minor*. *Anomodon attenuatus* differs from *A. minor* in its larger size, decurved, often stoloniform-attenuate branches, and acute, apiculate, sparsely serrulate leaves that are homomallous when dry.

Anomodon rugelii and *A. viticulosus* are more or less similar to *A. minor* in size and in having rounded leaf apices. Both species have leaves that are erect-incurved and somewhat contorted when dry, and often this feature will separate them from *A. minor* in the field. Microscopically the rounded-auriculate, non-decurrent leaves of *A. rugelii* that are fibriate-papillose on the basal margins, and the presence of pseudoparaphyllia distinguish it from *A. minor*. *Anomodon viticulosus* further differs from *A. minor* in having longer, erect-incurved and contorted leaves that are abruptly tapered from the shoulders into longer, narrower apices.

The aspect of *A. minor* when dry is so distinctive that with experience it can be readily recognized in the field. The species also has several microscopic features that help in its recognition. One peculiar feature is found in the basal juxtacostal cells near the leaf insertions, and may be correlated with its complanate leaves that are often infolded at the base on one side. In most leaves these cells are strongly dimorphic with the cells on the infolded sided long-rectangular to elongated and especially thick-walled, while the cells on the other side are rectangular to subquadrate and only moderately thickened. Another distinctive feature of *A. minor* is the tendency for its leaves below the middle to be bistratose in several rows along the costa. The presence of a complex annulus of vesiculose cells, the absence of stomata, and anisoporous spores are remarkable features of *A. minor*, but its sporophytes are rarely encountered.

The combination *A. minor* has often been attributed to Fürnrohr (1829). As noted by Grout (1934) Fürnrohr gave only a list of *Neckera* species that he thought should be placed in *Anomodon*, one of which was *Neckera minor* (Hedw.) P.-Beauv. Since Fürnrohr did not explicitly make the combination in *Anomodon* it can not be attributed to him.

3. *Anomodon rostratus* (Hedw.) Schimp., Syn. Musc. Eur. 488. 1860.
Leskea rostrata Hedw., Sp. Musc. Frond. 226. 1801.
Hypnum rostratum (Hedw.) P. Beauv., Prodr. Aethéogam. 69. 1805.

Plants medium-sized, in dull, yellowish green, thick, dense mats. Primary stems creeping, leaves reduced, 0.6–0.7 mm long, ovate-triangular to triangular, long hair-pointed; leaf cells pluripapillose; rhizoids red-brown in clusters at abaxial side of leaf insertions, not or weakly and irregularly branched. Secondary stems numerous, crowded, erect-ascending, 0.5–2 cm long, densely branched, in cross-section sclerodermis of 2–5 rows of small, thick-walled cells, cortical cells enlarged, firm- or thick-walled, central stand well-developed; paraphyllia and pseudoparaphyllia absent. Secondary stem and branch leaves erect-imbricate when dry, erect when wet, ovate-lanceolate, to 1.3 mm long, long-decurrent; apices acuminate, long, hyaline hair-pointed; margins plane or revolute at base, broadly revolute above to near the apex, papillose-crenulate, denticulate at the base of the decurrencies; costae single, ending below the apex, yellow, wavy, channeled on ventral surface, with elongate, seriate-papillose cells on the dorsal surface, in cross-section cells homogeneous, thick-walled; upper leaf cells hexagonal, oblong, rhomboidal to elongate, 10–24 x 3–4 µm, densely pluripapillose by thick, branched papillae, cells of the hair point smooth, basal cells along the margins and in the alar region oblate to quadrate, 8–10 µm, densely pluripapillose, inner basal cells near the costa elongate, thick-walled, often porose, to 40 µm long, cells in the basal decurrencies quadrate, weakly papillose. Dioicous. Perigonia and perichaetia gemmate, lateral on secondary stems. Setae elongate-flexuose, dark-red, 7–12 mm long. Capsules erect, oval-cylindrical to elliptic, 1.0–1.5 mm long, smooth, light-brown; exothecial cells small, oblate, thick-walled in 1–2 rows below the mouth, short-rectangular below; stomata at base; opercula obliquely conic-rostrate to 1 mm long; annuli rudimentary, cells often clinging to capsule mouth or operculum;, exostome white, narrowly triangular, dorsal (outer) surface horizontally papillose-striate in lower half, papillose above, ventral (inner) trabeculae projecting, endostome

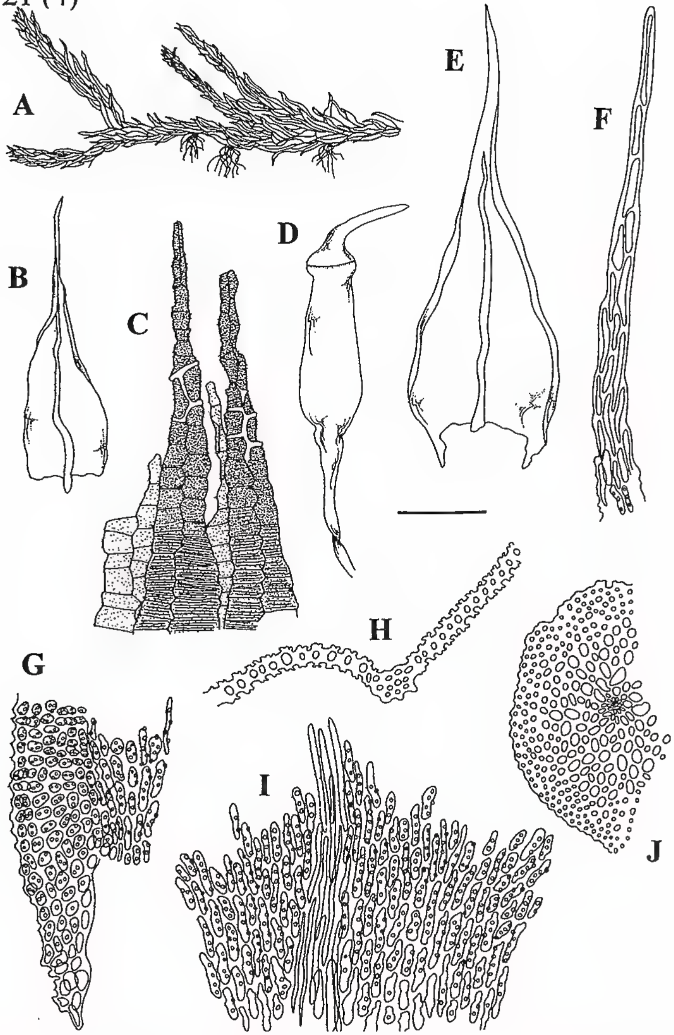

Figure 3. *Anomodon rostratus*. A. Habit. B. Branch leaf. C. Exostome teeth outer (dorsal) surface and endostomial segment and basal membrane. D. Capsule and operculum. E. Stem leaf. F. Leaf apex. G. Leaf decurrency. H. Leaf cross section below midleaf. I. Basal leaf cells. J. Stem in cross section. Scale in mm: bar = 0.05 (C,F–I), bar = 0.06 (J), bar = 0.28 (B,E), bar = 0.6 (D), bar = 2.0 (A). Figures C, D from *Allen 23783* (MO), all others from *Maine Mosses 76* (MO).

papillose, to ¾ the exostome length, segments narrow, rudimentary, basal membrane low, cilia absent. Spores spherical, smooth to lightly roughened, 10–15 µm. Calyptrae cucullate, smooth, 2 mm long. n = 10 + m, 11 (Fritsch 1991).

On boulders in woods, cliff faces, limestone outcrops, bark at base of tree trunks and roots, soil along trails, and over relic shell heaps. In Maine known from Androscoggin (*Merrill 103* MO, NEBC), Aroostook (*Collins 2371B* NEBC), Cumberland (*Allen 20269* MO), Hancock (*Spaulding 92* MO), Knox (*Allen 20051* MO), Lincoln (Allen & Pursell *Maine Mosses 76* DUKE, MAINE, MO, NY, US), Oxford (*Allen 21037* MO), Penobscot (*Merrill 116* MO, NEBC), Somerset (*Allen 9327* MO), and Washington (*Pedano 314* MO) Counties. Reported from Kennebec (Pitman 1928, 1929) County.

Anomodon rostratus often has a distinctive yellowish green color, and is immediately distinguished from the other Maine members of the genus by its long-acuminate, hyaline hair-pointed leaves. Other noteworthy features of the species include its densely matted habit, short secondary stems and branches, usually recurved upper leaf margins and inner basal leaf cells equally developed on both sides of the costa. Within *Anomodon* the setae and capsules of *A. rostratus* are comparatively short, while the rostrum of its operculum is over-sized. Granzow-de la Cerda (1997) considered the endostome of *A. rostratus* well-developed, but it is actually rudimentary with the segments reaching ¾ the length of the exostome only because of the shortness of the exostome teeth.

Anomodon rostratus and *A. attenuatus* are placed in subgenus *Pseudoanomodon* Limpr. on the basis of their greatly branched secondary stems, acute to acuminate leaves with the inner basal leaf cells equally developed on both sides of the costa, perichaetial leaves with enlarged apical cells, rudimentary annuli, stomata present, and relatively well-developed endostome. As noted by Buck (1998), however, they appear distantly related. *Anomodon rostratus* has a well-developed stem central strand, axillary hairs with 2–3 short, hyaline basal cells, small, mostly monomorphic leaves with recurved, entire upper margins, and reduced exostome teeth. In contrast *A. attenuatus* has no stem central strand, axillary hairs with a single brown basal cell, large dimorphic stem and branch leaves with plane often distantly denticulate upper margins, and well-developed exostome teeth.

4. *Anomodon rugelii* (C. Müll.) Keissl., Ann. Naturhist. Hofmus. 15: 214. 1900.
Hypnum rugelii C. Müll., Syn. Musc. Frond. 2: 472. 1851.
Anomodon apiculatus Bruch & Schimp. *ex* Sull. *in* Gray, Manual (ed. 2) 658. 1856.

Plants slender to medium-sized, in thick, dense, dark-green mats. Primary stems creeping, leaves reduced, 0.6–0.8 mm long, fragile, the lamina often broken, well-spaced, deltoid, strongly clasping below, rounded- auriculate at base, basal margins with fimbriate papillae; apices apiculate; rhizoids red-brown in clusters at abaxial side of leaf insertions, not or weakly and irregularly branched. Secondary stems erect, 2–3.5 cm long, sparsely and irregularly branched, occasionally with stoloniform-attenuate branches, in cross-section sclerodermis of 2–5 rows of small, red-brown, thick-walled cells, cortical cells enlarged, yellow to hyaline, firm-walled, central stand absent; paraphyllia absent, pseudoparaphyllia present. Secondary stem and branch leaves incurved-contorted when dry, erect-spreading to spreading when wet, fragile, lamina often breaking irregularly, oblong-ligulate from an ovate, broadly auriculate base, 1.5–2 mm long, not decurrent; apices rounded and variably apiculate; margins plane, papillose-crenulate, at times sparsely denticulate at apex, fimbriate-papillose on auriculate base; costae single, ending well below the apex, yellow, wavy and often forked above, cells on dorsal surface smooth, in cross-section cells homogeneous, thick-walled; leaf cells irregularly quadrate to hexagonal, at times oblate, 8–12 µm long, densely pluripapillose by thick, branched papillae, juxtacostal cells near the insertion weakly differentiated, equally developed on both sides of the costa, long-rectangular to oblong, 30–60 µm long, smooth or porose, weakly papillose to smooth. Dioicous. Perigonia not seen. Perichaetia gemmate, lateral on secondary stems. Setae elongate, yellow becoming red with age, flexuose, 9–15 mm long. Capsules erect, cylindrical, 2–2.5 mm long, smooth or lightly furrowed when dry, reddish-brown; exothecial cells small, oblate, thick-walled in 3–5 rows below the mouth, becoming subquadrate and short-rectangular below; stomata at junction of urn and seta; opercula obliquely or straight conic-rostrate 0.5–1 mm long; annuli rudimentary, cells often clinging to capsule mouth or operculum; exostome white to yellow, narrowly triangular to linear, dorsal (outer) surface lightly papillose below, densely papillose above, trabeculae laterally projecting, endostome papillose, to ½ the exostome length, segments narrow, rudimentary, basal membrane low, cilia absent. Spores spherical to subspherical, lightly papillose to nearly smooth, 8–12 µm. Calyptrae cucullate, smooth, 2–2.5 mm long. n = 11 (Fritsch 1991).

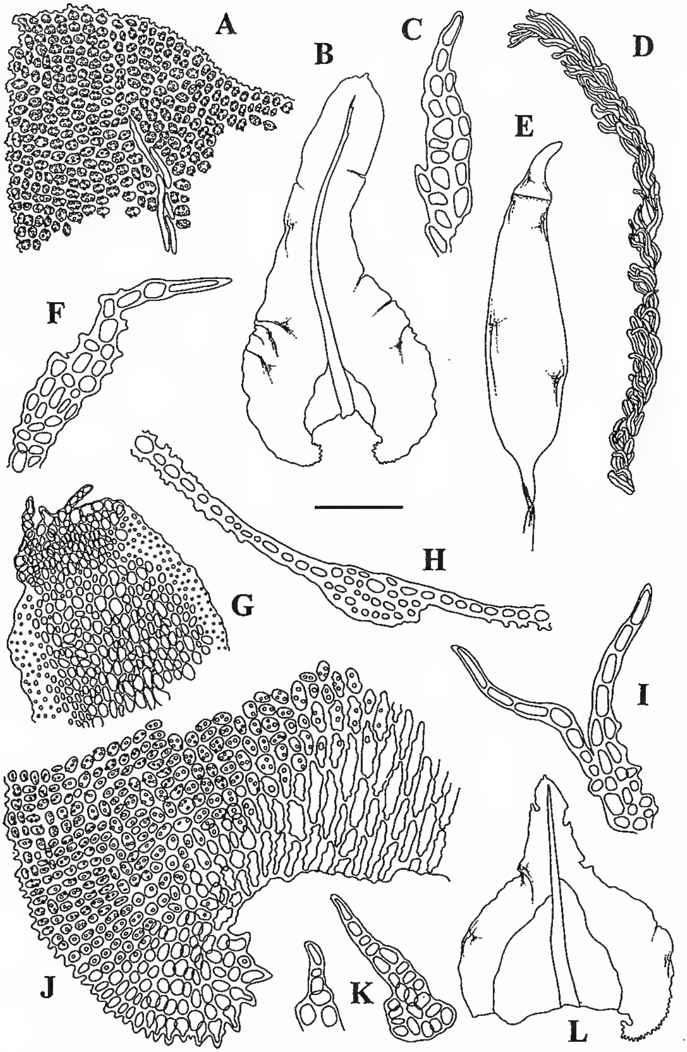

Figure 4. *Anomodon rugelii*. A. Leaf apex. B. Branch leaf. C., F., I., K. Pseudoparaphyllia. D. Habit. E. Capsule and operculum. G. Stem in cross section showing branch primordia and pseudoparaphyllia. H. Leaf cross section below midleaf. J. Basal leaf cells at margin. L. Stem leaf. Scale in mm: bar = 0.05 (C,F,H,I,K), bar = 0.06 (A,J), bar = 0.08 (G), bar = 0.26 (L), bar = 0.36 (B), bar = 0.71 (E), bar = 2.0 (D). Figure A from *Allen 20979* (MO), figure E from *Greene 5* (MO), all others from *Maine Mosses 125* (MO).

On bark of tree (*Acer* and *Fagus*) trunks, and on calcareous or granitic boulders. In Maine known from Aroostook (*Allen 16469* MO), Franklin (*Allen 22624* MO), Hancock (*Spaulding 93* MO), Kennebec (*Allen 24762* MO, NY), Oxford (*Allen 22519* MO), Penobscot (*Allen 24642* MO, NY), Piscataquis (*Merrill 171* MO, NEBC), and Somerset (Allen & Pursell, *Maine Mosses 125* DUKE, MAINE, MO, NY, US) Counties.

Anomodon rugelii, one of the more common *Anomodon* species in Maine, usually grows on bark at the base of trees, but can also be found on calcareous and granitic boulders. Plants of *A. rugelii* are sparsely branched, but there are numerous branch primordia along its stems and so it maintains the potential to be highly branched. It has a distinctive field aspect due to its broadly rounded leaves that are incurved-contorted when dry, but is often confused with *A. minor* or *A. viticulosus. Anomodon minor* is similar to *A. rugelii* in having broadly rounded leaf apices, but in that species the leaves are erect-imbricate when dry and never apiculate. *Anomodon rugelii* and *A. viticulosus* both have similarly rounded leaf apices that are incurved-contorted when dry, and they can be very difficult to distinguish in the field. *Anomodon viticulosus* is usually a more robust species than *A. rugelii* and its leaves are abruptly tapered from the shoulders into long, narrow apices, but the two species are more reliably distinguished microscopically. *Anomodon rugelii* differs from all other Maine species of *Anomodon* by its broadly auriculate, non-decurrent leaves that are fimbriate-papillose on the margins near the insertions, and its foliose pseudoparaphyllia. The often apiculate leaves of *A. rugelii* will (with the exception of *A. attenuatus*) also distinguish it from the other Maine *Anomodon* species. *Anomodon attenuatus* differs from *A. rugelii* in having more numerous stoloniform-attenuate branches with erect-homomallous leaves that are long, broadly decurrent, and have quadrate, densely papillose cells on upper dorsal costal surface.

The leaves of *A. rugelii* are fragile with the lamina tending to break along irregular lines, and as a result the auriculate leaf bases often remain on the stems after dissection. This critical feature of *A. rugelii* is therefore best observed at the leaf insertions on the stems after the leaves have been removed. Sporophytes of *A. rugelii* are not known from Maine, and possibly the fragile leaves are primarily responsible for the species dispersal.

Anomodon rugelii has leaf-like structures associated with its branch primordia and this critical feature of the species separates it from all *Anomodon* species except *A. longifolius* (Brid.) Hartm. These leaf-like structures have been called foliose pseudoparaphyllia (Ireland 1971, 1982; Granzow-de la Cerda 1997), however, this may be incorrect. The branch primordia of *A. rugelii* are exceptionally broad and the leaf-like structures are clearly associated with branch primordial cells and not stem epidermal cells (see Fig. 4G).

5. *Anomodon viticulosus* (Hedw.) Hook. & Tayl., Muscol. Brit. 79. 1818.
Neckera viticulosa Hedw., Sp. Musc. Frond. 209. 1801.
Hypnum viticulosum (Hedw.) L. *ex* With., Syst. Arr. Brit. Pl. (ed. 4) 3: 830. 1801.
Haptymenium viticulosum (Hedw.) Fürnr., Flora 10: 81. 1827.

Plants medium-sized to robust, in thick, dense, yellowish to glaucous-green, mats. Primary stems creeping, leaves reduced, 0.9–1.1mm long, moderately spaced, deltoid, clasping below, abruptly narrowed above the middle; rhizoids red-brown in clusters at abaxial side of leaf insertions, not or weakly and irregularly branched. Secondary stems erect, 3.5–8 cm long, not or sparsely branched, occasionally with stoloniform-attenuate branches, in cross-section sclerodermis of 2–5 rows of small, red-brown, thick-walled cells, cortical cells enlarged, yellow to hyaline, firm-walled, central stand present; paraphyllia and pseudoparaphyllia absent. Secondary stem and branch leaves erect-incurved, somewhat contorted and secund when dry, erect-spreading when wet, fragile, lamina often breaking irregularly, lance-ligulate from an ovate base, 2.5–3.5 mm long, long-decurrent; apices rounded-obtuse; margins plane or slightly recurved at base, papillose-crenulate; costae single, nearly reaching the apex, yellow, somewhat wavy above, not forked above, cells on dorsal surface papillose, in cross-section cells homogeneous, thick-walled; leaf cells irregularly quadrate to hexagonal, 10–12 µm long, densely pluripapillose by thick, branched papillae, juxtacostal cells near the insertion weakly differentiated, equally developed on both sides of the costa, long-rectangular to oblong, 12–40 µm long, smooth or weakly porose, weakly papillose to smooth. Dioicous. Sporophytes rare and not seen, description from Iwatsuki (1963), Crum & Anderson (1981), and Granzow-de la Cerda (1997). Setae 8–20 mm long, yellowish-brown. Capsules oblong-cylindrical, symmetric or slightly curved, 1.8–3.0 mm long, smooth or indistinctly furrowed when dry; stomata absent; opercula obliquely short-rostrate 0.7–1 mm long; annuli well-developed; exostome lance-linear, irregularly developed, yellow at base, smooth or faintly striate below, weakly papillose above, trabeculae not projecting, endostome segments ¼ to ¾ the exostome length, smooth or weakly papillose, basal membrane low. Spores papillose, variable between collections in some 20–23

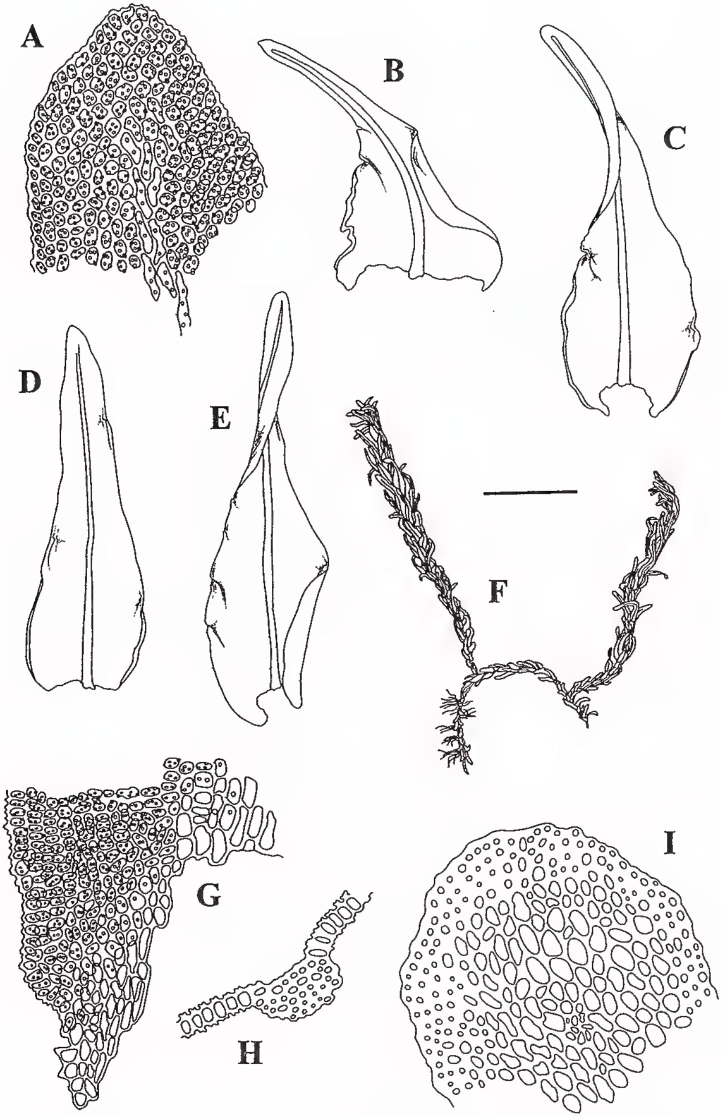

Figure 5. *Anomodon viticulosus*. A. Leaf apex. B. Stem leaf. C–E. Branch leaves. F. Habit. G. Basal leaf cells at margin. H. Costa in cross section. I. Stem in cross section. Scale in mm: bar = 0.06 (A,G–I), bar = 0.36 (B), bar = 0.6 (C–E), bar = 3.6 (F). All figures from *Allen 2976* (MO).

µm in others 15–16 µm. Calyptrae cucullate, smooth. n = 10 + m, 11 (Fritsch 1991).

Usually found on calcareous rocks, boulders, and vertical rock outcrops, occasionally growing on tree trunks. Reported from Oxford [North Hartford, *C. D. Adams* (Parlin 1939)] County.

Anomodon viticulosus is a fairly robust species with a yellowish green color. Its secondary stems are not or sparsely branched, and its obtuse to broadly rounded leaves are erect-incurved and somewhat contorted when dry. In Maine *A. viticulosus* is likely to be confused only with *A. minor* or *A. rugelii.* All three species have somewhat similar leaf shapes and rounded to obtuse leaf apices. *Anomodon rugelii* and *A. viticulosus* are easily confused in the field because they have sparsely branched secondary stems with fragile leaves that are incurved-contorted when dry. *Anomodon rugelii* is usually a smaller plant than *A. viticulosus*, has a dark-green color, and is nearly always found on tree trunks. Although a difficult feature to evaluate without experience, the two species have different leaf shapes: *A. viticulosus* leaves are abruptly tapered from the shoulders into long, narrow apices, *A. rugelii* leaves are broadly oblong-lingulate. Under the microscope the stem foliose pseudoparaphyllia of *A. rugelii*, and often apiculate leaves that are broadly auriculate and non-decurrent, with fimbriate papillose leaf margins near the insertions separate it from *A. viticulosus*. The leaves of *A. minor* are stiffly erect-imbricate when dry. They differ from those of *A. viticulosus* in their broadly oblong shape, and are often complanate with one side folded inward at base. A distinctive microscopic feature of the *A. minor* leaf is found in its basal juxtacostal cells near the leaf insertions. On one side the cells in this region are strongly differentiated, but only moderately so on the other side. In *A. viticulosus* the juxtacostal cells near the insertions are weakly differentiated and equally developed on both sides of the costa.

I have not seen any material of *A. viticulosus* from Maine, but it is known from Nova Scotia and New Brunswick (Ireland 1982), nearby Quebec (Favreau & Brassard 1988), Vermont (McQueen 1992), and Massachusetts (Mishler & Miller 1983). Although *A. viticulosus* occasionally grows on tree trunks, the species is much more common on calcareous rocks and rock outcrops.

2. *Haplohymenium* Dozy & Molk., Musci Frond. Ined. Archip. Ind. 127. 1846.

Plants small and slender, in dark-green or yellow–green, loose, wiry mats. Primary stems creeping, freely and irregularly branched, leaves reduced; leaf cells smooth to weakly papillose; rhizoids red-brown in clusters at abaxial side of leaf insertions, not or weakly and irregularly branched. Secondary stems weakly differentiated and often transformed to stolons at the tips, erect and loosely spreading, in cross-section sclerodermis of small, thick-walled cells, cortical cells enlarged, central stand absent; paraphyllia and pseudoparaphyllia absent. Secondary stem and branch leaves erect-imbricate when dry, spreading to squarrose when wet, ovate at base, shortly decurrent; apices acute to rounded, often apiculate, often fragile with leaf lamina broken or apices detached; margins plane or erect, papillose-crenulate, at times serrulate near the apex; costae single, usually ending near mid-leaf (rarely ⅝ the leaf length), yellow, somewhat channeled on ventral surface and covered by quadrate, papillose cells at the upper ends, in cross-section cells homogeneous, thick-walled; leaf cells rounded-quadrate, subquadrate, or irregularly hexagonal, bulging mammillose and pluripapillose or with a single, spinose papilla, juxtacostal cells near the insertion yellow, long-rectangular, weakly papillose to smooth. Dioicous. Setae short, 2–5 mm long. Capsules globose or oblong-ovate, 0.7–1.0 mm long; stomata absent; opercula rostrate; annuli complex; exostome teeth linear, verrucose, endostome rudimentary, consisting of a very short membrane. Calyptrae cucullate, with sparse hairs and papillae.

Haplohymenium is a genus of small, delicate plants that have erect-imbricate, often fragile leaves. *Haplohymenium triste* (Ces. *ex* De Not.) Kindb, the most widespread species, has this feature especially well-developed, and as a result fragile leaves are often considered of primary importance in defining the genus. This feaure, however, is not consistently present within *Haplohymenium*, and since some *Anomodon* species (*e.g., A. thraustus* C. Müll.) have extremely fragile leaves the genus is sometimes treated as a section of *Anomodon*.

Plants of *Haplohymenium* have a distinctive aspect due to their slender size and leaves that are erect-imbricate when dry. They have pluripapillose leaf cells, but the cells are also bulging mammillose and as a result the areolation clear and distinct. In contrast the leaf cells of *Anomodon* are densely papillose in such a way that the arreolation pattern is obscured. The best reasons for recognizing *Haplohymenium* at the generic level, however, are associated with its sporophytes. *Haplohymenium* has short setae (2–5 mm vs. 9–22 mm long in *Anomodon*), short, oblong-ovate to subglobose capsules, verrucose exostome teeth, a rudimentary endostome present only as a very low membrane, and sparsely hairy calyptrae. The genus was revised by Noguchi (1957) and Granzow-de la Cerda (1997).

The name *Haplohymenium* combines the Greek *haplo* (single) with *hymen* (membrane) in reference to its very reduced endostome.

Haplohymenium triste (Ces. *ex* De Not.) Kindb., Rev. Bryol. 26: 25. 1899.
Leskea tristis Ces *ex* De Not., Syllab. Musc. 67. 1838.
Anomodon tristis (Ces. *ex* De Not.) Sull. & Lesq., Musci Bor.-Amer. 52. 1856 [1857].

Plants small and slender, in dark-green or yellow–green, loose mats. Primary stems creeping, freely and irregularly branched, leaves reduced, 0.26–0.4 mm long, well-spaced, triangular to slenderly acuminate from an ovate-deltoid base; leaf cells smooth to weakly papillose; rhizoids red-brown in clusters at abaxial side of leaf insertions, not or weakly and irregularly branched. Secondary stems weakly differentiated, often transformed to stolons at the tips, erect and loosely spreading, 0.5–2.5 cm long, irregularly branched, in cross-section sclerodermis of 2–3 rows of small, thick-walled cells, cortical cells enlarged, yellow to hyaline, firm-walled, central stand absent; paraphyllia and pseudoparaphyllia absent. Secondary stem and branch leaves erect-imbricate when dry, spreading to squarrose when wet, ovate at base, abruptly narrowed to a lanceolate or lingulate acumen, 0.5–0.9 mm long, shortly decurrent; apices acute to rounded, often apiculate, extremely fragile, most leaves with lamina broken or apices detached; margins plane or erect, papillose-crenulate, at times serrulate near the apex; costae single, ending at or below mid-leaf, yellow, somewhat channeled on ventral surface and covered by quadrate, papillose cells at the upper ends, in cross-section cells homogeneous, thick-walled; leaf cells rounded-quadrate, subquadrate, or irregularly hexagonal, 8–11 µm, bulging-mammillose and pluripapillose, juxtacostal cells near the insertion yellow, long-rectangular, 15–36 µm long, weakly papillose to smooth. Dioicous. Sporophytes not seen, known only from Asia. "Setae 3–5 mm long, more or less curved. Capsules oblong 0.8–1.2 x 0.40–0.55 mm. Operculum 0.4–0.6 mm long. Exostome teeth 0.25–0.30 mm long. Spores 20–25 µm, densely papillose. Calyptra 1.2–1.5 mm long." (Noguchi 1991). n = 11 (Fritsch 1991)

On bark of tree (*Acer*, *Fraxinus*, and *Ostrya*) trunks or branches, rarely on boulders and rock outcrops. In Maine known from Hancock (*Magill 11800* MO), Kennebec (*Allen 25801* MO), and Oxford (*Ledlie 2099* MO) Counties.

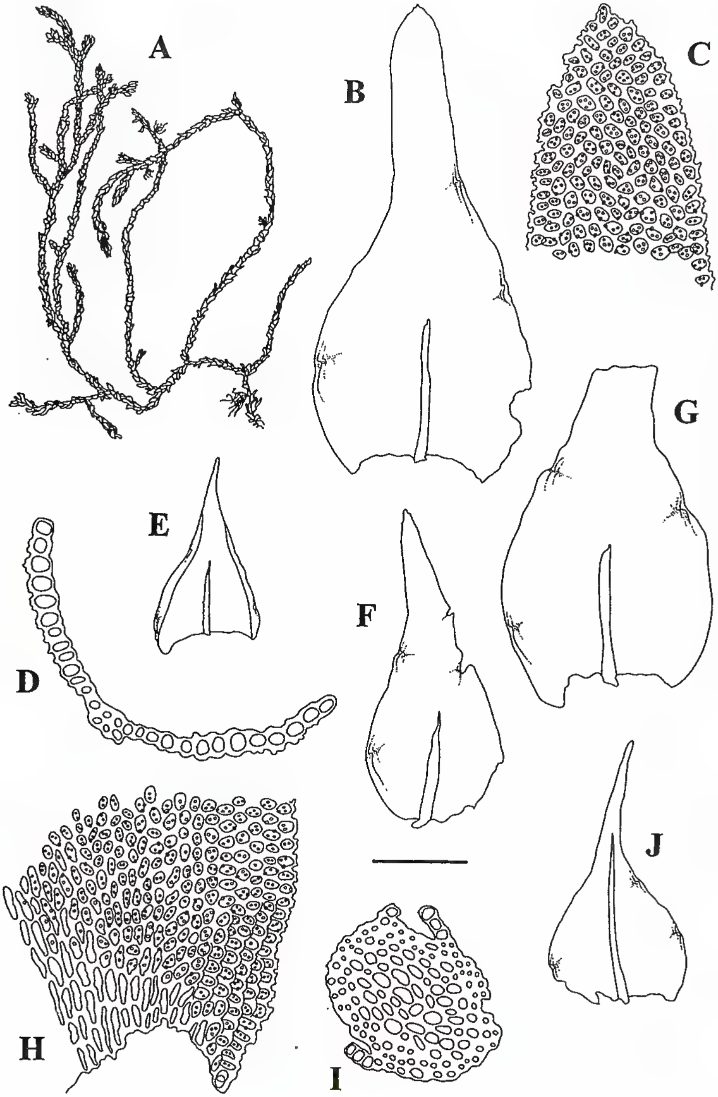

Figure 6. *Haplohymenium triste*. A. Habit. B, & G. Secondary stem leaves. C. Leaf apex. D. Leaf cross section below midleaf. E. & J. Primary stem leaves. F. Branch leaf. H. Basal leaf cells at margin. I. Stem in cross section. Scale in mm: bar = 0.05 (D), bar = 0.06 (C, H, I), bar = 0.13 (E, J), bar = 0.2 (B, F, G), bar = 3.2 (A). Figures A,D,E,I,J from *Magill 11800* (MO), figures B,C,F,G,H from *Valerio 178* (US).

Haplohymenium triste has a distinctive field aspect due to its small size, and occurrence in loose, wiry mats. Its leaves are erect-imbricate when dry, and this gives the branches a smooth, tightly julaceous appearance. The species is nearly always found on the bark of tree trunks or low branches, but it sometimes occurs on granitic or calcareous rocks. The leaf apices (and to a lesser degree the laminae) of *H. triste* are extremely fragile, and intact leaves normally can be found only at the tips of stems and branches. Under the microscope, its small size, lack of stem paraphyllia, pluripapillose and mammillose leaf cells, short, single costae, and fragile, ovate-lanceolate leaves will distinguish it from all other Maine moss species.

In an absolute sense *Haplohymenium* is distinguished from *Anomodon* only by sporophyte and calyptra features. Even though the *H. triste* sporophyte is unknown from North America and some *Anomodon* species have fragile laminae, the two genera are well separated in Maine. All Maine species of *Anomodon* are considerably larger in size than *H. triste*, and their costae end near the leaf apex. A more difficult feature to evaluate without previous experience with the genera is the difference in their leaf areolation. Both genera have pluripapillose leaf cells, but in *Haplohymenium* the cells are also bulging-mammillose. As result of this difference the cellular pattern in *Haplohymenium* is clear, while in *Anomodon* it is obscure.

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Bryophytes of the Interior Highlands of North America: New Arkansas, Missouri and Oklahoma County Records and Key for *Schistidium* in Missouri

Carl E. Darigo[1]

This paper reports on 186 new bryophyte, Arkansas, Missouri and Oklahoma county records in the Interior Highlands of North America, and also presents a preliminary key for *Schistidium* Brid. in Missouri. The Interior Highlands of North America is divided into several topographic regions, which include the southern portion of Missouri, much of Arkansas, a small section of southern Illinois, and extends along the eastern border of Oklahoma.

New moss county records for the Interior Highlands are distributed as follows:
ARKANSAS--79 new county records
  Boston Mountains (5): Independence-2, Marion-2, Van Buren-1
  Mississippi Lowlands (44): Cross-5, Lee-16, Phillips-13, Poinsett-10
  Salem Plateau (30): Clay-6, Izard-1, Lawrence-8, Randolph-7, Stone-8
OKLAHOMA--6 new county records
  Boston Mountains (6): Cherokee-6

New liverwort county records for the Interior Highlands are distributed as follows:
ARKANSAS--4 new county records
  Mississippi Lowlands (2): Lee-2
  Salem Plateau (2): Lawrence-1, Stone-1
MISSOURI—80 new county records
  Border Counties (12): Callaway-5, Lincoln-1, St. Charles-5, Warren-1
  Mississippi Lowlands (1): Scott-1
  Prairie (1): Henry-1
  St. Francois Mountains (5): Madison-4, Reynolds-1
  Salem Plateau (61): Bollinger-3, Camden-1, Crawford-6, Dent-2, Douglas-8, Franklin-7, Howell-2, Jefferson-3, Maries-5, Ozark-3, Phelps-5, Moniteau-2, St. Francois-2, St. Louis-1, Ste. Genevieve-3, Shannon-2, Texas-4, Washington-2

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OKLAHOMA--7 new county records
Boston Mountains (7): Cherokee-7

New hornwort county records for the Interior Highlands are distributed as follows:

MISSOURI--10 new county records
St. Francois Mountains (1): Madison-1
Salem Plateau (9): Bollinger-1, Dent-1, Franklin-2, Howell-1, Jefferson-1, Maries-1, St. Francois-1, Washington-1

The bryophytes reported in this paper were determined by the author; the more difficult specimens were verified by Bruce Allen (mosses) and Steve Timme (liverworts/hornworts). The basis for establishing new Interior Highlands moss county records is Redfearn (2004), the liverwort/hornwort records from Timme & Redfearn (1997) and Gier (1955). Oklahoma liverwort entries marked with * have been previously reported for Cherokee County by Little (1936), and are here included in the Interior Highlands. All collections are deposited at MO with exception of one, which is at KSP and so coded. Missouri county records are indicated by county name only, while the Arkansas and Oklahoma records are identified by county and state abbreviation.

MOSSES

AMBLYSTEGIACEAE

Amblystegium serpens (Hedw.) Schimp. *in* B.S.G. var. ***serpens*** **Phillips AR**: Rd 1901, St. Francis National Forest, *Darigo & Sullivan 4066.*

A. varium (Hedw.) Lindb. **Cherokee OK**: Foster property, 7 miles SE of Tahlequah, *Holmberg & G. Foster 338.*

Campylium chrysophyllum (Brid.) J. Lange **Clay AR**: Corning city park, *Darigo 3863.* **Lawrence AR**: Lake Charles State Park, *Darigo 3876.* **Lee AR**: Rd 1902, St. Francis National Forest, *Darigo & Sullivan 4054.* **Poinsett AR**: Lake Poinsett State Park, *Darigo 4081.* **Randolph AR**: Old Davidsonville State Park, *Darigo 3869.*

C. hispidulum (Brid.) Mitt. **Lawrence AR**; Lake Charles State Park, *Darigo 3874.*

Hygroamblystegium tenax (Hedw.) Jenn. var. ***tenax*** **Lee AR**: Lone Pine CG, St. Francis National Forest, *Darigo & Sullivan 4047.* **Phillips AR**: Rd 1901, St. Francis National Forest, *Darigo & Sullivan 4061.* **Stone AR**: Blanchard Spring, Ozark National Forest, *Holmberg 289.*

Leptodictyum humile (P. Beauv.) Ochyra **Izard AR**: Mt. Olive White River access, *Darigo 3886*. **Lee AR**: Rd 1902, St. Francis National Forest, *Darigo & Sullivan 4057*. **Phillips AR**: Rd 1901, St. Francis National Forest, *Darigo & Sullivan 4065*.

ANOMODONTACEAE

Anomodon attenuatus (Hedw.) Hüb. **Lawrence AR**: Lincoln Cemetery, Hwy 25, *Darigo 3882*. **Phillips AR**: Horner Lake Trail, St. Francis National Forest, *Darigo & Sullivan 4038*. **Stone AR**: N Sylamore Creek, Ozark National Forest, *Darigo 3888*.

A. rostratus (Hedw.) Schimp. **Lee AR**: Bear Creek Lake Trail, St. Francis National Forest, *Darigo & Sullivan 4067*.

AULACOMNIACEAE

Aulacomnium heterostichum (Hedw.) Bruch & Schimp. in B.S.G. **Stone AR**: N Sylamore Creek, Ozark National Forest, *Darigo 3887*.

BRACHYTHECIACEAE

Brachythecium acuminatum (Hedw.) Aust. var. ***acuminatum*** **Phillips AR**: Rd 1901, St. Francis National Forest, *Darigo & Sullivan 4062*.

B. laetum (Brid.) B.S.G. **Clay AR**: Corning city park, *Darigo 3865*. **Cross AR**: Village Creek State Park, *Darigo 4069*. **Lee AR**: Lone Pine CG, St. Francis National Forest, *Darigo & Sullivan 4041*. **Poinsett AR**: Lake Poinsett State Park, *Darigo 4078*.

Bryoandersonia illecebra (Hedw.) Robins. **Poinsett AR**: Lake Poinsett State Park, *Darigo 4077*.

Eurhynchium hians (Hedw.) Sande-Lac **Cross AR**: Village Creek State Park, *Darigo 4073*. **Poinsett AR**: Lake Poinsett State Park, *Darigo 4083*.

E. pulchellum (Hedw.) Jenn. var. ***pulchellum*** **Clay AR**: Corning city park, *Darigo 3864*.

Steerecleus serrulatus (Hedw.) Robins. **Lee AR**: Rd 1902, St. Francis National Forest, *Darigo & Sullivan 4052*. **Phillips AR**: Rd 1901, St. Francis National Forest, *Darigo & Sullivan 4063*.

BRYACEAE

Bryum capillare Hedw. var. ***capillare*** **Stone AR**: Blanchard Spring, Ozark National Forest, *Darigo 3892*.

B. dichotomum Hedw. **Van Buren AR**: Shirley mushroom factory, *Darigo 3897*.

Pohlia wahlenbergii (Web. & Mohr) Andrews **Stone AR**: Shelter Cave, Ozark National Forest, *Darigo & Sullivan 3893*.

Rhodobryum ontariense (Kindb.) Par. *in* Kindb. **Cherokee OK**: Foster property, 7 miles SE of Tahlequah, *Holmberg & R. Foster 345*.

CLIMACIACEAE

Climacium americanum Brid. **Stone AR**: Blanchard Spring, Ozark National Forest, *Darigo 3890*.

DITRICHACEAE

Pleuridium subulatum (Hedw.) Rabenh. **Cherokee OK**: Jerson property, 7 miles SE of Tahlequah, *Holmberg & G. Foster 335*.

ENTODONTACEAE

Entodon seductrix (Hedw.) C. Müll. **Clay AR**: Corning city park, *Darigo 3866*. **Cross AR**: Village Creek State Park, *Darigo 4072*. **Lee AR**: Lone Pine CG, St. Francis National Park, *Darigo & Sullivan 4043*. **Phillips AR**: Horner Lake Trail, St. Francis National Forest, *Darigo & Sullivan 4039*.

FABRONIACEAE

Clasmatodon parvulus (Hampe) Hook. & Wils. *ex* Sull. *in* Gray **Lee AR**: Lone Pine CG, St. Francis National Forest, *Darigo & Sullivan 4046*. **Phillips AR**: Rd 1901, St. Francis National Forest, *Darigo & Sullivan 4037*. **Poinsett AR**: Lake Poinsett State Park, *Darigo 4085*. **Randolph AR**: Old Davidsonville State Park, *Darigo 3870*. **Stone AR**: Shelter Cave, Ozark National Forest, *Darigo 3894*.

FISSIDENTACEAE

Fissidens taxifolius Hedw. **Poinsett AR**: Lake Poinsett State Park, *Darigo 4084*. **Randolph AR**: Old Davidsonville State Park, *Darigo 3872*.

GRIMMIACEAE

Schistidium sp. *"v"* **Marion AR**: Buffalo Point, Buffalo National River, *Darigo 3895*. **Cherokee OK**: Foster property, 7 mi SE of Tahlequah, *Holmberg & R. Foster 344*.

Hans Blom is presently working on a revision of *Schistidium* in North America and has found many new *Schistidium* species in North America. His preliminary treatment of the genus in Missouri indicates that none of the taxa previously reported for the state actually occur there. According to Missouri material at MO annotated by Blom, four taxa occur in the state, only one of which has previously been described. The following key to *Schistidium* in Missouri is presented as a preliminary aid to indentifying the taxa in the state. This key was also used to determine the Arkansas and Oklahoma collections listed above.

Schistidium Key - Missouri

1. Leaf margins plane, apices muticous; plants dioicous; exothecial cells very incrassate, walls 3–6μm wide .... 2. *Schistidium* sp. *"cr"*

1. Leaf margins variously revolute on one or both sides, apices often with hair

points; plants autoicous; exothecial cells firm-walled, < 3µm wide 2

2. Plants small, frequently rusty-red; leaves < 1.5 mm in length, margins often plane on one side; capsules ovoid, length/width ratio < 1.3 .... 3. *Schistidium liliputanum* (C. Muell.) Deguchi

2. Plants medium-size to large, dark-green, greenish black to black, or brownish; leaves > 1.5 mm in length, margins revolute on both sides; capsules oblong to cylindrical, length/width ratio > 1.3 3

3. Leaf margins often multi-stratose above; ventral (inner) surface of peristome at base with papillae arranged in vertical rows or striate, dorsal (outer) surface of peristome at base smooth; spores 10–12µm .... 4. *Schistidium* sp. *"v"*

3. Leaf margins uni- or bi-stratose; both surfaces of peristome papillose at base; spores 13–16µm .... 1. *Schistidium apocarpum* (Hedw.) Bruch & Schimp. *in* B.S.G. ssp. *"ca"*

HYPNACEAE

Hypnum lindbergii Mitt. **Lee AR**: Rd 1902, St. Francis National Forest, *Darigo & Sullivan 4056.*

Platygyrium repens (Brid.) Schimp. *in* B.S.G. **Cross AR**: Village Creek State Park, *Darigo 4071.* **Lee AR**: Lone Pine CG, St. Francis National Forest, *Darigo & Sullivan 4049.*

LEPTODONTACEAE

Forsstroemia trichomitria (Hedw.) Lindb. **Stone AR**: Blanchard Spring, Ozark National Forest, *Darigo 3889.*

LESKEACEAE

Haplocladium virginianum (Brid.) Wat. & Iwats. **Lee AR**: Rd 1902, St. Francis National Forest, *Darigo & Sullivan 4055.*

Leskea gracilescens Hedw. **Lawrence AR**: Lake Charles State Park, *Darigo 3875.* **Phillips AR**: Rd 1901, St. Francis National Forest, *Darigo & Sullivan 4064.*

LEUCOBRYACEAE

Leucobryum glaucum (Hedw.) Ångstr. *in* Fries **Lawrence AR**: Lincoln Cemetery, Hwy 25, *Darigo 3881.*

LEUCODONTACEAE

Leucodon julaceus (Hedw.) Sull. **Clay AR**: Corning city park, *Darigo 3862.* **Cross AR**: Village Creek State Park, *Darigo 4070.* **Lee AR**: Lone Pine CG, St. Francis National Forest, *Darigo & Sullivan 4045.* **Phillips AR**: Rd

1901B, St. Francis National Forest, *Darigo & Sullivan 4040.* **Poinsett AR**: Lake Poinsett State Park, *Darigo 4086.* **Randolph AR**: Old Davidsonville State Park, *Darigo 3873.*

PLAGIOMNIACEAE

Plagiomnium ciliare (C. Müll.) T. Kop. **Lee AR**: Rd 1902, St. Francis National Forest, *Darigo & Sullivan 4058.* **Poinsett AR**: Lake Poinsett State Park, *Darigo 4082.* **Randolph AR**: Old Davidsonville State Park, *Darigo 3871.*

P. cuspidatum (Hedw.) T. Kop. **Lawrence AR**: Lake Charles State Park, *Darigo 3879.* **Lee AR**: Lone Pine CG, St. Francis National Forest, *Darigo & Sullivan 4048.* **Phillips AR**: Rd 1901, St. Francis National Forest, *Darigo & Sullivan 4059.* **Poinsett AR**: Lake Poinsett State Park, *Darigo 4080.*

POLYTRICHACEAE

Atrichum altecristatum (Ren. & Card.) Smyth & Smyth **Lee AR**: Lone Pine CG, St. Francis National Forest, *Darigo & Sullivan 4042.* **Independence AR**: Lee's Chapel Cemetery, Hwy 25, *Darigo 3885.* **Randolph AR**: Old Davidsonville State Park, *Darigo 3868.* These reports are the first for this species in the Arkansas portion of the Interior Highlands of North America.

A. angustatum (Brid.) Bruch & Schimp. *in* B.S.G. **Lawrence AR**: Lake Charles State Park, *Darigo 3878.* **Lee AR**: Rd 1902, St. Francis National Forest, *Darigo & Sullivan 4053.* **Phillips AR**: Rd 1900K, St. Francis National Forest, *Darigo & Sullivan 4050.* **Poinsett AR**: Lake Poinsett State Park, *Darigo 4079.*

POTTIACEAE

Astomum muehlenbergianum (Sw.) Grout **Independence AR**: Lee's Chapel Cemetery, Hwy 25, *Darigo 3884.*

Barbula unguiculata Hedw. **Clay AR**: Corning city park, *Darigo 3861.* **Marion AR**: Buffalo Point, Buffalo National River, *Darigo 3896.*

Tortula plinthobia (Sull. & Lesq.) Sull. **Cherokee OK**: Foster property, 7 miles SE of Tahlequah, *Holmberg & R. Foster 347.*

Weissia controversa Hedw. **Phillips AR**: Rd 1901, St. Francis National Forest, *Darigo & Sullivan 4060.* **Randolph AR**: Old Davidsonville State Park, *Darigo 3867.*

THUIDIACEAE

Thuidium delicatulum (Hedw.) Schimp. *in* B.S.G. **Lawrence AR**: Lincoln Cemetery, Hwy 25, *Darigo 3880.*

T. recognitum (Hedw.) Lindb. **Cherokee OK**: Foster property, 7 miles SE of Tahlequah, *Holmberg & R. Foster 346.*

LIVERWORTS

ANEURACEAE

Aneura pinguis (L.) Dum. **Bollinger**: Wash Creek, Mark Twain National Forest, *Brant 5257*. **Crawford**: James Branch, Mark Twain National Forest, *Brant 5533*. **Dent**: Indian Creek, Mark Twain National Forest, *Brant 5540*. **Douglas**: Spring Creek, Mark Twain National Forest, *Holmberg 150*. **Franklin**: Shaw Nature Reserve, *Holmberg 547*. **Ste. Genevieve**: John's Creek, Mark Twain National Forest, *Brant 5295*.

AYTONIACEAE

Asterella tenella (L.) P. Beauv. **Crawford**: Todd Hollow, Mark Twain National Forest, *Brant 5564*. **Dent**: White Run Trace Conservation Area, *Holmberg 529*. **Franklin**: Oak Grove Church Rd, *Holmberg 363*. **Henry**: Truman Reservoir, *Harris 37*. **Madison**: Millstream Gardens Conservation Area, *Holmberg 553*. **Phelps**: Beaver Creek Conservation Area, *Holmberg 522*. **St. Francois**: St. Francois State Park, *Allen 25007*. **Ste. Genevieve**: Brushy Creek, Mark Twain National Forest, *Brant & O'Donnell 5313*. **Texas**: Quercus Flatlands Natural Area, *Holmberg 526*. **Warren**: Katy Trail State Park, *Holmberg 187*. **Washington**: Little Lost Creek, Mark Twain National Forest, *Brant 5481*. ***Cherokee OK**: Jerson property, 7 miles SE of Tahlequah, *Holmberg & G. Foster 336*.

Reboulia hemisphaerica (L.) Raddi **Callaway**: Cedar Creek, Mark Twain National Forest, *Holmberg 271*. **Douglas**: Greasy Creek, Mark Twain National Forest, *Holmberg 141*. **Phelps**: Hwy P, W of Newburg, *Holmberg 119*. **St. Charles**: Klondike County Park, *Holmberg 517*. ***Cherokee OK**: Jerson property, 7 miles SE of Tahlequah, *Holmberg & G. Foster 334*.

CALYPOGEIACEAE

Calypogeia fissa (L.) Raddi ssp. ***neogaea*** Schust. **Franklin**: private property, Whiskey Creek Rd, *Holmberg 472*. **Maries**: James Hale property, *Holmberg 546*.

CODONIACEAE

Fossombronia brasiliensis Steph. **Jefferson**: Victoria Glade, TNC, *Holmberg 521*. **Maries**: James Hale property, *Holmberg 544*. **Phelps**: Beaver Creek Conservation Area, *Holmberg 523*. **Texas**: Quercus Flatlands Natural Area, *Holmberg 525*.

CONOCEPHALACEAE

Conocephalum conicum (L.) Lindb. **Callaway**: Cedar Creek, Mark Twain National Forest, *Holmberg 270*. **Crawford**: Todd Hollow, Mark Twain National Forest, *Brant 5564A*. **Madison**: Wash Creek, Mark Twain National Forest, *Brant & O'Donnell 5286*.

JUBULACEAE

Frullania eboracensis Gott. **Franklin**: Whiskey Creek Rd, *Holmberg & Younkin 186*. **Jefferson**: Victoria Glade, TNC, *Holmberg 519*. **Maries**: private property E of Paydown, *Holmberg 414*. **Ozark**: Caney Mountain Conservation Area, *Holmberg 430*. **St. Francois**: Knoblick Towersite Conservation Area,
Holmberg 551.

F. ***inflata*** Gott. **Crawford**: Seener Tract, *Holmberg 507*. **Douglas**: Shannon Ranch Conservation Area, *Holmberg 410*. **Howell**: Siloam Springs, Mark Twain National Forest, *Holmberg 137*. **Lincoln**: Cuivre River State Park, *Darigo 3996*. **Madison**: Silver Mines, Mark Twain National Forest, *Holmberg 283*. **Moniteau**: Manito Lake Conservation Area, *Holmberg 309*. **Phelps**: Hwy P, W of Newburg, *Holmberg 118*. **Texas**: Simmons Ford Access, *Holmberg 412*. ***Cherokee OK**: Foster property, 7 miles SE of Tahlequah, *Holmberg & G. Foster 339*.

F. ***riparia*** Hampe *ex* Lehm. **Callaway**: Big Branch, Mark Twain National Forest, *Holmberg 276*. **Maries**: Mill Spring Creek, E of Paydown, *Holmberg 417*. **Ozark**: Caney Mountain Conservation Area, *Holmberg 433*. **St. Charles**: Weldon Spring Conservation Area, *Holmberg 261*. ***Cherokee OK**: Foster property, 7 miles SE of Tahlequah, *Holmberg & R. Foster 348*.

LEJEUNEACEAE

Cololejeunea biddlecomiae (Aust.) Evans **Moniteau**: Prairie Home Conservation Area, *Holmberg 315*.

LOPHOCOLEACEAE

Chiloscyphus profundus (Nees) Eng. & Schust. **Lawrence AR**: Lake Charles State Park, *Darigo 3877*. **Lee AR**: Rd 1902, St. Francis National Forest, *Darigo & Sullivan 4051*. **Douglas**: Spring Creek, Mark Twain National Forest, *Holmberg 151*. **Maries**: Hwy 42, E of Paydown, *Holmberg 415*. **St. Charles**: Weldon Spring Conservation Area, *Holmberg 260*.

C. ***pallescens*** (Ehrh. *ex* Hoffm.) Dum. var. ***pallescens*** **Ste. Genevieve**: Bidwell Creek, Mark Twain National Forest, *Brant 5299*.

MARCHANTIACEAE

Marchantia aquatica (Nees) Burgeff **Reynolds**: Whittlesey property, Calyotte Hollow, *Brant 5595*.

Preissia quadrata (Scop.) Nees **Douglas**: Hungry Creek, Mark Twain National Forest, *Holmberg 146*. **Shannon**: E of Rat, *Holmberg 286*.

PELLIACEAE

Pellia epiphylla (L.) Corda **Bollinger**: Forest Rd 2137, Mark Twain National Forest, *Brant 5425*. **Crawford**: Sugar Tree Hollow, Mark Twain National

Forest, *Brant 5432*. **St. Charles**: Klondike County Park, *Harris 40*. **St. Louis**: Flat Creek, Eureka, *Holmberg 86*.

PLAGIOCHILACEAE

Plagiochila porelloides (Torrey *ex* Nees) Lindenb. **Douglas**: Hungry Creek, Mark Twain National Forest, *Holmberg 148*. **Jefferson**: Pacific Palisades Conservation Area, *Holmberg 132*.

PORELLACEAE

Porella pinnata L. **Douglas**: Greasy Creek, Mark Twain National Forest, *Holmberg 143*.

P. platyphylla (L.) Pfeiff. **Callaway**: Cedar Creek, Mark Twain National Forest, *Holmberg 272*. **Camden**: Lake of Ozarks State Park, *Holmberg 117*.

P. platyphylloidea (Schwein.) Lindb. **Lee AR**: Lone Pine CG, St. Francis National Forest, *Darigo & Sullivan 4044*. **Stone AR**: Blanchard Spring, Ozark National Forest, *Darigo 3891*. **Franklin**: Whiskey Creek Sheep Farm, Krakow, *Holmberg 125*. **St. Charles**: Weldon Spring Conservation Area, *Holmberg 262*. ***Cherokee OK**: Foster property, 7 miles SE of Tahlequah, *Holmberg & R. Foster 343*.

PTILIDIACEAE

Trichocolea tomentella (Ehrh.) Dum. **Crawford**: Huzzah Creek, Mark Twain National Forest, *Brant 5494*.

RADULACEAE

Radula complanata (L.) Dum. **Callaway**: Big Branch, Mark Twain National Forest, *Holmberg 275*. **Howell**: Siloam Springs, Mark Twain National Forest, *Holmberg 136*. **Ozark**: Caney Mountain Conservation Area, *Holmberg 431*. **Washington**: Pea Ridge Conservation Area, *Holmberg 305*.

R. obconica Sull. **Douglas**: Greasy Creek, Mark Twain National Forest, *Holmberg 142*. **Shannon**: Medley Hollow, Mark Twain National Forest, *Holmberg 287*.

RICCIACEAE

Riccia fluitans L. **Franklin**: Shaw Nature Reserve, *Holmberg 223*. **Scott**: Charlestown Baptist Camp, *T. Smith et al. 3928A*.

SCAPANIACEAE

Scapania nemorea (L.) Grolle **Madison**: Silver Mines, Mark Twain National Forest, *Holmberg 284*. **Phelps**: Woodson Woods Conservation Area, *Holmberg 530*. **Cherokee OK**: Jerson property, 7 miles SE of Tahlequah, *Holmberg & G. Foster 337*.

S. undulata (L.) Dum. var. ***undulata*** **Texas**: Quercus Flatlands Natural Area, *Holmberg 527*.

SPHAEROCARPACEAE

Sphaerocarpos texanus Aust. **Bollinger**: Castor River, *Brant 5275*. **Franklin**: Whiskey Creek Sheep Farm, Krakow, *Holmberg 124*. **Cherokee OK**: Alcorn property, 7 miles SE of Tahlequah, *Holmberg & G. Foster 342*.

HORNWORTS

ANTHOCEROTACEAE

Anthoceros laevis ssp. ***carolinianus*** (L.) Schust. **Bollinger**: Castor River, *Brant 5416*. **Dent**: White Run Trace Conservation Area, *Holmberg 528*. **Franklin**: Whiskey Creek Sheep Farm, Krakow, *Holmberg 515*. **Jefferson**: Victoria Glade, TNC, *Holmberg 520*. **Madison**: Millstream Gardens Conservation Area, *Holmberg 552*. **Maries**: James Hale property, *Holmberg 545*. **St. Francois**: Knoblick Towersite Conservation Area, *Holmberg 550*. **Washington**: Little Lost Creek, Mark Twain National Forest, *Brant 5469*.

Aspiromitus punctatus ssp. ***agrestis*** (Paton) Schust. **Franklin**: Whiskey Creek Sheep Farm, Krakow, *Holmberg 516*(KSP). **Howell**: Tingler Lake Conservation Area, *Holmberg 524*.

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Distribution of Trace Elements in Moss Biomonitors Near Mumbai

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Abstract: *Elemental composition of mosses from Mahabaleshwar, a remote hill station near Mumbai was measured. Trace element profiles of two different species of mosses were compared. Chemical analysis for washed and unwashed moss samples was done using Energy Dispersive X-ray Fluorescence Spectrometry (EDXRF) and Instrumental Neutron Activation Analysis (INAA) techniques in an attempt to understand the variation. The comparative concentration of Al, Sr , Zn and Rb in both the mosses reflected the order of abundance of metal in the soil. The enrichment factor of Pb, was found more in* Pinnatella alopccuroides *than the other one whereas enrichment factor of Cr was more in* Pterobryopsis flexiceps *compared to* Pinnatella alopccuroides. *So they can be preferentially used as bioindicators for respective elements.*

Introduction: Air pollution study using biomonitors is emerging as an interesting and economic alternative to those performed by means of direct measurement specially in monitoring large areas (Ruhiling & Tyler 1968). The usefulness of mosses in determining the trace and toxic element concentration in different geographical areas were demonstrated in several studies. Many European countries have used mosses and lichens since the beginning of 60's in the national and multinational surveys of atmospheric metal deposition. (Ruuling 1994) The multielement analysis method namely Energy Dispersive X-Ray Florescence Spectrometry (EDXRF) and Instrumental Neutron Activation Analysis (INAA) together permit the determination of large number of major and minor trace elements. In the present study mosses namely *Pinnatella alopccuroides* and *Pterobryopsis flexiceps,* were collected from Mahabaleshwar, a considerably remote area near Mumbai, were analyzed to generate knowledge about input of heavy metal from distant emission sources (Berg & Steinnes. 1997). The concentration of heavy metal in mosses were carried out by EDXRF and INAA. Unwashed and washed moss samples were measured to understand the chemical composition of elements that were physically trapped on the surface of thallus.

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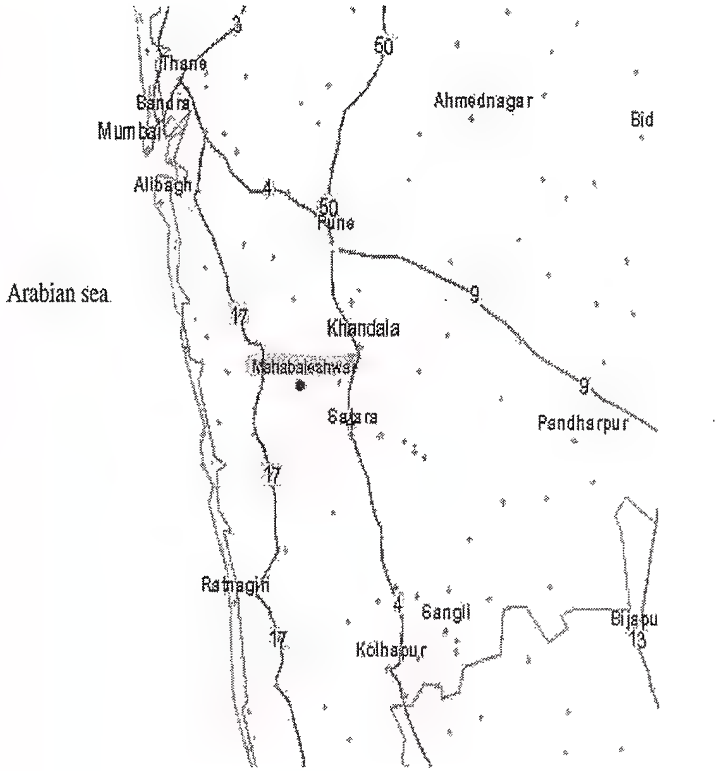

Figure1: Map showing Mahabaleshwar near Mumbai

Materials and Method: *Study Area:* The sampling site Mahabaleshwar is located at 17.58°N and 73.43°E and 4500feet (1372m) above the sea level in the heart of Sahyadri Hills in Satara District, Maharastra, in the midst of dense forest. The 1200 metre sequence of Mahabaleshwar is about 140km South east of Mumbai. (Figure 1) The annual rainfall of this site is 6250mm.The area is located at a road distance of about 300km away from main industrial town of Mumbai. The place is mainly free from industries and vehicular activities.

Sampling and Sample Preparation: The collection of the moss samples namely *Pinnatella alopccuroides* and *Pterobryopsis flexiceps* .were performed according to the protocol adopted within the European Heavy Metal Survey (Gerdol, Bragazza, Marchesini & Alber, et al., 2000). Moss samples were collected at a distance of at least 500m from main roads, 200 m from local roads and 1 km from inhabited areas .The samples were taken in forest glades or an open heath to reduce through-fall effects from the forest canopy. Each sample was composed of 5-10 sub samples collected within the area of 50 $m^{2.}$ (Steinnes, Berg & Sjobakk. 2003). This is done to make each moss sample representative for a reasonably large area.

Moss samples were sorted to remove extraneous material. Each sample was divided into two parts, one was washed with double distilled water and the other was unwashed. The samples were homogenized, grinded with mortar and pestle finely and freeze dried. One gram of dried and homogenized powder was taken for making pellets and mixed with ultra pure cellulose powder. Samples were pressed by 20 tons hydraulic press to obtain the pellet. The pellets were analyzed by EDXRF model 3600,Jordon Valley using suitable transmission filters to remove primary beam continuation and provide a monochromatic target-line excitation sources (Jha, S.K,, & V.D. Puranik. 2002). To obtain optimum excitation for low Z elements (like Al,V) Cu filter was used ,whereas Mo filter was used to analyze Zn, Pb, Rb, Sr.' The details of analytical methodologies are described in Jha,.et.al 2002.

For INAA analysis,30 mg. homogenized moss sample was packed in a double sealed polythene bag and sent along with 30 mg. of Certified Reference Material IAEA lichen 336.

They were irradiated in thermal neutral column of Apsara reactor in Bhabha Atomic Research Centre for 7 hrs with neutron flux of 10^{12} neutron/cm^2/sec. The counting system consists of an PCA based PHAST card coupled with HPGe detector of 25% relative efficiency and a resolution of 1.8 kev at 1332 kev. La was detected after three days of cooling while other elements like Zn, Cr, Rb were measured after 4 weeks. Quantification was carried out comparing the peak area of particular element in sample with peak area of the elements in certified reference standards.

The concentration of Rb and Zn, estimated both by EDXRF and INAA were compared. It was found the estimates are within 2 to 3. The analyses were checked by repeated measurements of 10 samples. The overall errors including the sample were estimated to be about less than 5%. The Cr, Zn, and La value presented here obtained from INAA analysis.

For quality control of the analytical process, the standard reference materials CRM lichen 338 from IAEA were simultaneously analyzed.

Result & Discussion: The elemental concentrations in the unwashed and washed samples of mosses namely *Pinnatella alopecuroides* (Hook.)Feisch. and *Pterobryopsis flexipes*(Mitt.)Fleisch. are presented in Table 1 &2.The unwashed moss gives higher concentration of trace elements compared to the washed one. The ratio of unwashed to washed moss samples comes to more than one reflecting the trapping of soil dust in mosses. The enrichment factor of an element gives information on its anthropic origin and is calculated by the equation:

$$EF=C_x/C_n(\text{ambient}):C_x/C_n(\text{background})$$

Where C_x is the concentration of the element whose enrichment is to be determined and C_n is the concentration of the normalising element assumed to be the characteristic of the background.In our study the ambient consists of moss samples and the background consists of samples of the surrounding samples (Bergamaschi & Rizzio. 2002).

The enrichment factor for different elements was calculated with respect to local soil in the two different mosses namely *Pinnatella alpccuroides* and *Pterobryopsis flexipes.* Higher enrichment factor for Pb, Rb, and Sr was observed in the moss *Pinnatella alpccuroides.* Moss namely *Pterobryopsis flexipes* shows high enrichment factor for Cr, whereas the behavior of *Pinnatella alpccuroides* is different for this element. The enrichment factor for the anthropogenic element V is almost same for both the mosses.

Conclusion: Results show that pattern of trace element composition in moss deviate from the soil. The unwashed mosses show high concentration of trace elements due to soil particles at the surface of the thallus. *Pterobryopsis flexipes* shows preferential uptake of Cr, and can be used as biomonitors for Cr in the environment. Both the mosses behave similarly for other anthropogenic elements as Pb, and V.

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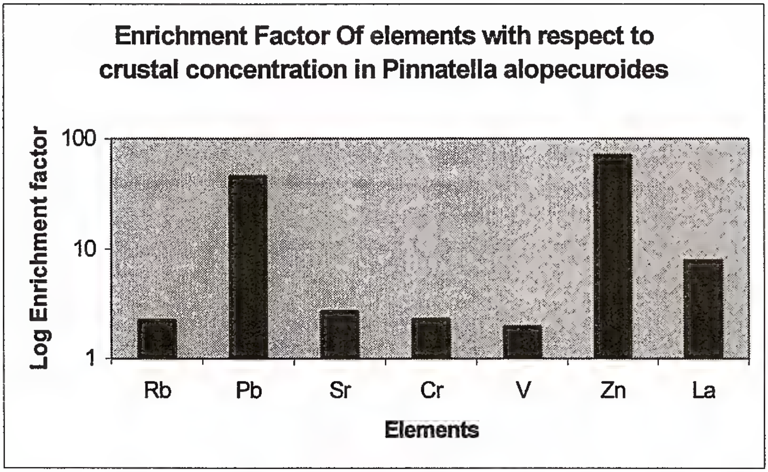

Figure 2-Enrichment factor of Elements in *Pinnatella alopecuroides*

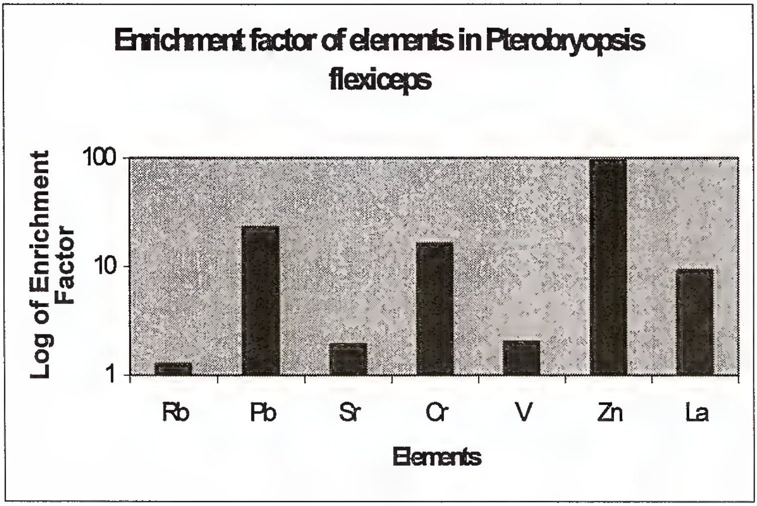

Figure 3-Enrichment factor of elements in *Pterobryopsis flexiceps*

Table 1:
Amount of Trace Elements in Moss *Pinnatella alopecuroides* (Hook.) Feisch. from Mahabaleshwar (Results are in mg/kg)

Washed moss samples				Unwashed moss samples		
Elements	Maximum value	Minimum value	Mean value	Maximum value	Minimum Value	Mean value
Al	1661.00	1017.00	1435.66	1987.24	1562.61	1772.61
Rb	1.56	1.55	1.55	5.53	4.59	5.06
Sr	8.84	5.9	7.37	29.06	16.52	21.66
Cr	2.39	1.61	2.05	4.96	4.26	4.61
V	10.86	7.2	9.03	15.29	11.28	13.28
Zn	179.59	105.53	138.55	482.85	350.98	398.95
La	4.21	2.94	3.39	6.89	5.58	6.33
Pb	11.45	10.89	11.11	14.69	12.35	13.85

Table-2
Amount Of Trace Elements in *Pterobryopsis flexipes* (Mitt.) Fleisch

Washed moss samples				Unwashed moss samples		
Elements	Maximum value	Minimum value	Mean value	Maximum value	Minimum Value	Mean Value
Al	1661.76	890.59	1179.97	1992.00	1225.65	1365.00
Rb	1.94	1.75	1.82	2.15	2.13	2.12
Sr	11.30	7.04	8.81	19.32	13.21	14.32
Cr	3.93	2.455	2.30	5.23	4.96	5.01
V	7.80	3.78	5.69	15.23	8.32	10.32
Zn	144.13	104.76	90.52	366	296.32	312.32
La	5.96	4.31	5.04	11.32	6.32	8.65
Pb	5.83	4.57	5.07	10.69	6.32	9.58

Table-3
Ratio of elements in unwashed and washed moss samples

Elements	Unwashed : washed *Pinnatella alopecuroides* (Hook.)Feisch.	Unwashed : washed *Pterobryopsis flexipes* (Mitt.) Fleisch.
Al	1.23	1.15
Rb	3.25	1.16
Sr	2.94	1.62
Cr	2.01	2.29
V	1.47	1.81
Zn	2.88	3.45
La	1.86	1.71
Pb	1.24	1.88

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